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11473

CONTENTS

Nos. 1–2, September-October, 1937

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1147

CONTENTS

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HYMENOPHYLLUM

By E. B. COPELAND

Formerly of the Department of Agriculture and Commerce, Manila

EIGHTY-NINE PLATES

To complete the family, my treatise on *Trichomanes* in the Old World[1] is now followed by a corresponding study of *Hymenophyllum*.

Trichomanes is a natural assemblage of fairly coördinate natural groups of species, having common characters which make the genus easily recognizable and definable. But these groups are almost all likewise clearly delimited, and are so easily recognizable and definable that only the fact that in a few details I was unable to make the job clean, clear, and finished, restrained me from treating these groups as genera, and my *Trichomanes* as a subfamily—as Presl and van den Bosch had done long before.

In contrast to *Trichomanes*, *Hymenophyllum* has seemed to be homogeneous, not composed of a considerable number of definable minor groups which could possibly be regarded as genera. Our ideas of the evolution of species almost compel the assumption that phyletic groups, independent after their origin, exist. I write "almost," because there is the possible alternative assumption that hybridization across the boundaries of such original groups has been general enough to produce a tangled or knotted skein instead of a divaricate system of phyletic lines. In this case "natural" and "polyphyletic," as applying to the groups, would cease to be antithetic terms. It is our custom,

[1] Philip. Journ. Sci. 51 (1933) 119–230, pls. 1–61.

right or wrong, to ignore this possibility. I will presently question the soundness of this practice.

There are of course in *Hymenophyllum* many groups of evidently related species. But nobody has hitherto been able to break the genus into such groups, with any confidence that they are natural, and to assign nearly every species to one or another of them. While this was the case, there was no such temptation as in the case of *Trichomanes* to raise even the recognizable groups to generic rank. Van den Bosch, criticizing Presl for setting up genera, appropriately quotes (Synopsis, p. 5 of reprint) Fries: "Vana sunt nova genera, sine universali specierum cognitione. ."

A number of the groups of species have been given names. Those first named and described as genera and including Oriental species are *Meringium*, *Leptocionium*, *Myrmecostylum*, and *Sphaerocionium*, all proposed by Presl in his Hymenophyllaceæ, in 1843.

Meringium was based on *M. Meyenianum* Presl, op. cit. 116, collected "at Manila" by Meyen, and doubtfully (and wrongly) included a second species, *H. blumeanum* Spr. The genus was ascribed to Trichomanoideæ, and *M. Meyenianum* was transferred to *Trichomanes* by van den Bosch. While little confidence can be placed in the accuracy of Presl's drawings, I am sure that this is the same plant described in the same work, page 140, as *Didymoglossum serrulatum*, and of late known as *Hymenophyllum serrulatum* (Presl) C. Chr. That it belongs in this group is manifest from the serrate margin and the form of the involucre. I identify it specifically by the form of the marginal teeth, the large, not very deeply cleft involucre with entire lips, and the fact that the species is common in the mountains of Rizal Province, the mountains nearest to Manila.

Leptocionium, ibid. 118, was founded on the Chilean *L. dicranotrichum*, with a doubtful second species, *L.? fucoides*, *Hymenophyllum fucoides* Sw. By its author it was distinguished from *Hymenophyllum* by its elongate, exserted receptacle. Incidentally, the margin was figured as ciliate and described as incisodentate with serrate teeth. The name has acquired importance because it was "emended in use" by van den Bosch and Hooker, and by more recent writers in general applied to a group, generic or subgeneric, eventually including all species with toothed margin, all those with entire margin being "*Euhymenophyllum*." These terms, as used, are absolutely untenable. Whatever the

size and rank of any group to be called *Euhymenophyllum*, it must include the type of the genus, which has a toothed margin. Both Presl and van den Bosch realized this, and neither used *Leptocionium* in a sense broad enough to include *H. tunbridgense*. Moreover, if the great group of Palaeotropic ferns which have been called *Leptocionium* is held distinct from *Hymenophyllum* proper, the name of this group is *Meringium*, since this name antedates (by position) *Leptocionium*, and is typified by one of them.

Myrmecostylum, ibid. 119, based on *H. tortuosum*, similar to *Leptocionium*, is mentioned here because it is ascribed to New Zealand; it came really from the Antarctic American region.

Sphaerocionium, ibid. 125, with *H. hirsutum* Sw. as the species first enumerated, was set up as a large genus distinguished from *Hymenophyllum* by having the receptacle sterile at the base and enlarged at the apex, where it bears stalked sporangia. As proposed by Presl, it was not at all a natural group, but comprised species independently related to various minor natural groups left by Presl in *Hymenophyllum*. If, however, one were disposed to divide *Hymenophyllum* into two genera, distinguished by serrate and entire margins, *Sphaerocionium* would have to be the name of the great group with entire margin, of late known as *Euhymenophyllum;* in his third supplement, Christensen uses the term in this sense, for a subgenus. I adopt another alternative; to apply the term to a fairly well-defined smaller group, typified by its type species. This group, with ciliate margins and mostly stellate hairs, was recognized by Hooker in his Species Filicum, but has since rather lost recognition.

In the Addenda to his Epimeliae Botanicae (1849) 253, Presl proposed two additional genera:

1. *Mecodium*, with one species, *Hymenophyllum sanguinolentum* Sw., of New Zealand, without generic diagnosis other than that it is "analogous" in *Hymenophyllum* to *T. pallidum* in *Trichomanes*.

2. *Amphipterum*, with what is now called *H. fuscum* as its species, characterized by winglike outgrowths of the axes. This is a small, definable group, related to *Meringium*, but probably not nearly so to the American species with similar wings.

Van den Bosch, Versl. Akad. Wet. Amsterdam 11 (1861) 300, in an outline of his understanding of the proper classification of the family, proposed rather than established two additional genera: *Pachyloma*, typified by *H. marginatum;* and *Diplocophyllum*, typified by *H. dilatatum*.

Hymenophyllum and *Trichomanes* are related. When they are well understood, if they are genera in a proper sense, it should be possible to recognize in each a relatively primitive element, most nearly related to the other. In *Trichomanes*, *T. pyxidiferum* can be selected with considerable justification as representing such a group. The corresponding group in *Hymenophyllum* should have an entire margin, and be without peculiar hairs. This fixes the primitive element far less precisely than in the case of *Trichomanes*. In the latter genus, the unspecialized group is characterized by filiform rhizome, absence of false veins, and absence of any kind of peculiarly thickened laminar cell walls, and the first two of these characterize the whole genus *Hymenophyllum*. Toothed margin, stellate pubescence, and supplementary wings on the rachis may be construed as features of specialization, marking the groups which uniformly display them as nonprimitive. Observing these principles, and noting its world-wide distribution as evidence of age, *H. polyanthos* might be regarded as representing the most primitive element in *Hymenophyllum*.

There is evidence subject to construction, and construed by Presl and in effect by van den Bosch, as marking a very different group of species as intermediate between *Trichomanes* and *Hymenophyllum*—those with partly tubular involucre and elongate receptacle.

Beside distinctions between the gametophytes and sporangia, which are not known for a sufficient number of species to establish their validity, the two genera have two general diagnostic differences: The involucre or indusium is cleft, deeply or to the bottom, in *Hymenophyllum*, consisting then of two "valves," while it is not thus cleft in *Trichomanes*. And the receptacle of *Hymenophyllum* is typically of definitely limited growth, and included by the involucre, while it is of comparatively unlimited growth, exceeding the involucre, in *Trichomanes*. Neither of these criteria is absolute. A species regarded as *Hymenophyllum* on other grounds, but with long, extruded receptacle, is on this ground easily suspected of affinity to *Trichomanes*. Likewise, a species of *Trichomanes* with the involucre cleft, however shallowly, is subject on this ground to the suspicion of affinity to *Hymenophyllum*. *Didymoglossum*, including *Taschneria*, has been regarded as an intermediate genus, on the latter ground. In this case, I dismiss the evidence as fallacious, believing that the bilabiate apex of the involucre is without genetic relation to the cleft involucre of *Hymenophyllum*.

There is, however, a considerable group of species, ascribed to *Hymenophyllum*, characterized both by elongate receptacles and by involucres cleft part-way down but not to the base—often not nearly so. This group includes *Meringium* and *Amphipterum* of Presl, regarded by him as intermediate genera.

That expression—intermediate—in Presl's time might express merely a combination of diagnostic characters. Today, if carefully used, it appraises this combination of characters as evidence of affinity. If the group seemed to be primitive in other respects, the features just mentioned would suffice to fix it quite positively as really related to *Trichomanes*, and therefore really intermediate. In fact, though, instead of being apparently primitive in other respects, it is the one group of species ascribed to *Hymenophyllum* that displays the greatest structural specialization. Because this is so, I am constrained to believe that the features of resemblance to *Trichomanes* are not due to mutual phylogenesis. While I postulate *H. polyanthos* as primitive in a monophyletic genus *Hymenophyllum*, I cannot also believe that a group with serrate margins and crested involucres—conspicuous features nowhere suggested by any sure species of *Trichomanes*—is more related to *Trichomanes* than are the many species with entire margins and crestless involucres.

The foregoing propositions, which are not true, or are hard to accept, all arise from the basic assumption that *Hymenophyllum* is a natural genus, a monophyletic group, homogeneous in comparison with *Trichomanes*, containing some primitive element ancestral to the rest of the genus. They have largely disappeared as problems, because I have come to the positive conclusion that *Hymenophyllum* is not a group of this kind. If there is a distinction in this respect, *Hymenophyllum* is even less homogeneous than *Trichomanes*. But the task of recognizing and identifying the natural groups collected in *Hymenophyllum* has proven incomparably more difficult than in *Trichomanes*.

As far as my work is concerned, this might well be because the groups in *Trichomanes* were largely recognized and defined by my predecessors; but this course of history may fairly be ascribed to the fact that the groups in *Trichomanes* are more easily recognized, and have therefore invited study. Mettenius, Prantl, and Giesenhagen, all studying intensively the anatomy of these plants, as a foundation for taxonomic work at which they never arrived, devoted much attention to species of *Tricho-*

manes and comparatively little to those of *Hymenophyllum*. Van den Bosch alone undertook a careful study of the known species of *Hymenophyllum*. He died just when his data were ready to serve for the proper grouping of the species; and the study of the voluminous notes in his herbarium has been a wonderful object lesson as to the amount of information that can be assembled, and then lost. Even the data published in the two supplements to his Synopsis have been completely overlooked by later writers, although they are far more comprehensive than the collective work of the three to whom I have just referred.

Substantial conditions which have prevented or made difficult the recognition of the natural groups within *Hymenophyllum*, as I see these conditions and these groups today, are—

1. The absence of single conspicuous criteria for the recognition of such groups. *Trichomanes* is really remarkable for such convenient criteria—the false veinlets of *Taschneria*, the marginal strand of *Crepidium*, the frond form of *Cephalomanes*, the cell structure and cell arrangement of *Abrodictyon*. Except for single species like *H. Malingii* and *H. odontophyllum*, which have no effect on the problem as a whole, and except for the stellate hairs of *Sphaerocionium*, such convenient and infallible criteria are wanting in *Hymenophyllum*. Any unknown *Trichomanes*, of unknown origin and sterile, can be assigned positively to its group. With my present knowledge, at any rate, this is far from true of *Hymenophyllum*.

2. To recognize the groups of *Hymenophyllum*, we have to some extent to use characters of degree, or characters dependent upon complete maturity. With the exception of *Sphaerocionium* all larger groups in *Hymenophyllum* depend for recognition upon characters of the sorus; and the extent to which the involucre is cleft and the length of the receptacle (if it is slender) are matters of degree.

3. The major groups within *Hymenophyllum* have to be recognized by combinations of characters. The groups in *Trichomanes* have of course combinations of characters, but can mostly be recognized by single ones; and where combinations are required, as to distinguish between the groups of *T. radicans* and *T. apiifolium*, which are alike in absolutely simple laminar structure, the diagnostic difference (elongate rhizome or erect caudex) is so obvious as to be used almost unconsciously.

4. Most confusing, the group criteria in *Hymenophyllum* are not infallible. By far the most familiar of these is the mar-

gin, as toothed or entire. I am perfectly sure that *H. macroglossum*, *H. Lobbii*, and *H. penangianum*, with entire margins, belong in a group characterized by marginal teeth. I believe that *H. Reinwardtii*, *H. thuidium*, and *H. samoense*, with serrulate margins, belong in a group otherwise without teeth. And there are several pairs of species—*H. Deplanchei* and *H. Baileyanum*, *H. macrocarpum* and another plant on the same mountain doubtfully referable to *H. polyanthos*—one toothed, the other entire, which are so alike that it is hardly possible to question their affinity.

5. Complication of the evolutionary "tree" by ancestral hybridization. I have already noted that this possibility is usually ignored, and that I cannot continue to ignore it. Conclusive proof of ancestral hybridization is in the nature of the case very difficult. I am not entirely convinced that it has happened between the major groups in *Hymenophyllum*, although it offers the simplest explanation of the occurrence of pairs of similar species not referred to the same group.

But there are some phenomena which seem to me to be explicable in no other manner, namely:

1. The occurrence in the New Zealand area, and nowhere else, of species with the lamina wholly or partly more than one cell thick—*H. dilatatum*, *H. demissum*, *H. australe*. Except in this one respect, these species do not seem very nearly related. This phenomenon is so remarkable in this family that it led van den Bosch to establish a subfamily to include these species; but in other respects they seem so clearly to belong in separate minor groups that even his proposed genus, *Diploophyllum*, is untenable. This one character looks like a common inheritance. With all other characters testifying to distinct ancestry, the apparent explanation is that this one character was planted in several minor groups by hybridization. It may be postulated that the remote enough ancestors of the whole family had leaves structurally like those of other ferns, and that the plural layers of these species are vestigial. Why then is the phenomenon restricted in area? And is it mere coincidence that *Cardiophyllum* is endemic in the same area?

2. Many New Zealand species have in common a peculiar odor, evidently responsible for the name of *H. sanguinolentum*, although to my sense of smell it is not that of blood. In some cases these species are related as judged by other characters; in other cases they seem to belong in quite distinct groups. The relatives of *H. rarum* in the South African region retain

this odor. The same explanation, hybridization in the past, will apply to the presence of this odor in species of different minor groups; and the alternative explanation, that it is a vestigial character, can hardly be invoked in this case.

While *H. dilatatum*, *H. demissum*, *H. multifidum*, and *H. australe* have been supposed to range across the Malay region, New Zealand seemed, as far as the evidence of this genus went, to be a part of that great region. I find now that all of these are local species, not even very nearly related to the Malayan ferns which have been confused with them; and doubt if any one of the many New Zealand species ranges as far as the New Hebrides, New Caledonia, or Samoa. In an altogether local flora, a character implanted by hybridization, in a group where it is otherwise foreign, may be supposed to have a far better chance to persist, than it would have where it is more exposed to the swamping-out influence of a greater, more diverse, more competitive flora.

3. There is, however, a fairly evident case of the same kind in the richest of all fern floras: the presence in New Guinea of a considerable number of species with dark, opaque, rather coriaceous fronds—*H. opacum*, *H. ovatum*, *H. firmum*, and *H. geluense*. There are others, but these four are cited because, with this conspicuous textural character in common, they seem otherwise to belong in four very distinct groups or subgroups. I can imagine no local peculiarity of climate or soil able to produce this result by parallel or convergent evolution, and therefore turn again to hybridization between groups and subgroups as the only acceptable explanation.

We describe, classify, and identify plants by means of their "characters." In practice, the characters used are morphological, as preserved in the herbarium. The usefulness of a character in taxonomy and identification depends primarily upon its constancy; as one character may be variable from individual to individual and thus, within the range of variation, be useless in the description or identification of the species; another may be constant for the species and serve for specific characterization; while others are constant for groups of various sizes and ranks, and serve as group characters. As a secondary consideration, the usefulness of a character depends upon its ease of perception.

Since the utility of a character depends upon its constancy, and the constancy can be appraised only by the comparison of many specimens, it is obvious that the more ample the material

subjected to careful study (up to the indefinite amount necessary for safe, final judgment), the sounder will be the conclusions as to the species and other groups. As I have been able to study several times as much material as van den Bosch, and many times as much as any other student of *Hymenophyllum* seems to have used, my conclusions have a correspondingly greater probability of correctness. Still, like all who have gone before, I have described new species from a single collection, which in itself affords little opportunity to appraise the validity of its specific characters.

There is always some measure of insecurity in assuming the value of any character for purposes of diagnostic description. It is particularly unsafe to assume that because a character is useful for these purposes with one species or in one group, it has the same value in other cases. I do not know that any character is always equally serviceable, and suppose that none is so. As an ideal procedure, every character should be tested every time it is used. No standards of thoroughness demand this in the study of a flora still in considerable part unknown. I have tested some of the characters used in this study, for the identification of some species, with considerable thoroughness, and have been surprised by their lack of constancy. Thus, *H. formosum* has been credited with a certain very characteristic form of receptacle, but I find this structure varying far from its description, even in the type collection. The same study which led to this observation showed, though, that it varies within limits; that this species (which will be called *H. imbricatum*) is perfectly distinct in this character from its common and similar neighbor, *H. emarginatum*, and practically so from its nearer relatives, *H. Junghuhnii* and *H. badium*. Because the examination of many hundreds of sori of these species has taught us the limits of common variation, we have been able, by examining one sorus of the type of *H. emarginatum* to determine positively which of several species, bearing other and later names, ought to bear that name.

With the same thoroughness we have tested the form of the involucre of *H. polyanthos*, and the presence of toothlike infoldings of parts of its marginal walls. So also the structure of the walls of several species. More careful study has repeatedly shown that what looked at first like good specific characters, and what have been so accepted, are inconstant, not merely from place to place or from plant to plant, but even on different parts of single fronds.

Outgrowths of peculiar patterns—ribs, crests, teeth—on the tube of the involucre, beautifully illustrated in Hymenophyllaceae Javanicae, have been regarded as exact diagnostic characters of the several species producing them. We have found these structures far from constant, varying in size and distribution, to a certain extent interchangeable, and possibly absent in certain places (the ventral face of the tube); but that after our examination of almost innumerable sori we can still use them, and more safely, for specific recognition; and that now they serve also for the detection of relationships, as the Philippine *H. serrulatum* is found to be most nearly related, among Javan species, to *H. holochilum*. But just such crests and teeth have no diagnostic value at all in the case of *H. sanguinolentum*, and I describe *H. gorgoneum*, as characterized by them, without enough material for any appraisal of their constancy in its case. The next writer may have to treat it as I treat *H. cristulatum*.

I abstain from a further discussion of the value of the individual characters at this point, because it has to be taken up in many individual cases in the course of this treatise.

Returning to the subject of the phylogeny of *Hymenophyllum*, and of the phyletic groups into which I try to break it up, the proposed groups are as follows:

Phyletic group.	Species	Typified by
1. *Meringium*	Many	*H. Megalocaulon* Presl.
2. *Amphipterum*	4	*H. fuscum* Blume
3. *Myriodon*	1	*H. achrostophyllum* Copel.
4. *Hemiphlebium*	2	*H. Baileyanum* Hamlin.
5. *Polyphlebium*	Many	*H. tunbridgense* (L.) Smith
6. *Mecodium*	Many	*H. polyanthos* Sw.
7. *Craspedophyllum*	1	*H. sanguinolentum* Forst. and G.
8. *Sphaerocionium*	Many	*H. hirsutum* Sw.
9. *Apteropteris*	1	*H. Malingii* Hooker.

Postponing a fuller discussion of each of these to its individual presentation, I will note here, for purposes of general introduction, that *Amphipterum* and *Myriodon* are local derivatives of *Meringium;* that *Craspedophyllum* is likewise local, and probably derived from *Mecodium;* that *Apteropteris* is a local relative of *Sphaerocionium;* and that all four of these groups are maintained because their separate recognition gives no more than proper emphasis to their respective remarkable peculiarities, and their removal from the larger groups leaves the latter

easier to define. In a discussion of *Hymenophyllum* as a whole, they require no further mention.

Meringium has one African species and ranges thence to Polynesia. I have not yet tried to determine whether the American species that have been called *Leptocionium* are *Meringium*, or *Euhymenophyllum*, or both, or neither. *Euhymenophyllum*, *Mecodium*, and *Sphaerocionium* are cosmopolitan, as that word is understood in dealing with this family.

Meringium is like *Trichomanes*, and unlike *Hymenophyllum*, as usually defined, in its long-exserted receptacle. In this respect, and also in the cell walls of many species, it is particularly like the group of *T. rigidum*, which I have regarded as far from primitive. The tubular lower half of the involucre is also suggestive of *Trichomanes*, but I mistrust this character as evidence of common inheritance.

Boschia is like that group of *Trichomanes* which has seemed to me most primitive—that of *T. pyxidiferum* and *T. radicans*, in its complete lack of structural differentiation (in the lamina). It is impossible for me to believe that *Mecodium* is descended from *Meringium* or *Meringium* from *Mecodium*. While both may be recognized as related to *Trichomanes*, they are independently so related.

Euhymenophyllum is, in its diagnostic characters, intermediate between *Meringium* and *Mecodium*. In my opinion, this is not because either of these is related through it to the other. Its discontinuous distribution suggests that it is very old. It is conceivable that it is ancestral to *Meringium*. To test this possibility, let us assume that some element in *Trichomanes* is the ancestor of *Hymenophyllum*. Then, in the evolution of *Meringium*, the receptacle was first shortened and then restored, and the tube of the involucre was cleft and then largely restored. Without evidence—and there is none—we do not adopt such hypotheses. Of course, it is a mere assumption that *Trichomanes* is the ancestor of *Hymenophyllum*. But, if we would picture the usual type of genealogical tree for all of these groups, some group must be placed in the position of the most primitive; and whatever group is placed there, difficulty of the kind just presented will ensue. *Trichomanes* has to be considered in any such attempt. If this were not so, it would require a relatively slight strain of the imagination to regard *H. polyanthos*, or *H. peltatum*, or something like *H. edentulum* as primitive, and the whole of *Meringium*, *Euhymenophyllum*, and *Mecodium* as derived therefrom. As it is, these three

groups impress me as coördinate, unquestionably related, but with a common ancestry which I neither know nor picture.

Somewhat different data enter into a discussion of *Sphaerocionium*, but a discussion of them along the lines just followed would lead to the same conclusion—that this is a fourth coördinate group. There is one point of particular interest in *Sphaerocionium;* namely, that it is probable ancestor to a group of species, "*Microtrichomanes*," with so much superficial resemblance to *Trichomanes* that most of them have been placed there without the mention of a doubt. After describing *Trichomanes Lyallii* (Trichomanes 163), I commented: "This is not merely congeneric with *Hymenophyllum obtusum;* it is hardly more than a reduced form of that species, which, in small but still fertile forms, becomes more flabellate than pinnate. I am not questioning the generic position of *H. obtusum*, nor the affinity of *T. Lyallii* and *T. palmatifidum;* but am leaving *Microtrichomanes* in *Trichomanes*, until the question of generic boundaries may be studied as a whole."

The species in question is a *Sphaerocionium*, *Hymenophyllum Lyallii* Hooker, correctly placed when discovered. *Trichomanes palmatifidum* and *T. Ridleyi* are also species of *Hymenophyllum*, in the broad and usual sense. We encounter here again the phenomenon of the loss of common distinguishing criteria in the course of the simplification inevitable with much reduction in size. However similar the little flabellate representatives of the two genera may be—and the likeness goes so far that I would not think of separating them generically without knowing their generically distinct relatives (ancestry)—this resemblance is not proof or, once the case is understood, even evidence of affinity. *Hymenophyllum* and *Trichomanes* converge here; they have not diverged from a common ancestry represented by their simplified species.

The foregoing argument shows that I agree with my predecessors in the study of this family—Presl, van den Bosch, and Prantl—that the customary assignment of all species to two genera cannot be justified. However, because the fixing of the tenable genera will best be done for the entire family at one time, and because I desire this treatise, as a matter of convenient use, to be a companion to my Trichomanes, I reserve the presentation of the genera, as such, for later publication.

As material for this study, I have had my own herbarium, the Philippine National Herbarium, and on loan the appropriate collections from the University of California, the United States National Herbarium, the Gray Herbarium, the Queensland Herbarium, and, preëminently important in this family, the Rijks Herbarium, Leyden. The last contains the specimens, manuscripts, and drawings of van den Bosch, published and unpublished. To the directors and curators of these herbaria, and particularly to Doctor Lam, I would express better than I can my sense of obligation and gratitude. For assistance with particular plants, I take pleasure in acknowledging the courtesy of Doctor Christensen in sending me the type material of his *H. carduneulus* and of several Madagascar species; of the Berlin Herbarium in sending type material of *H. Rosenstockii* and *H. herterianum;* of Mr. Holttum in lending the type of his *H. johorense;* and of the Stockholm Herbarium in permitting me to examine a fragment of the type of *H. emarginatum.*

I have also gratefully to acknowledge assistance in the compilation of the literature by Dr. E. Quisumbing and by the library staff of the Bureau of Science; by Dr. H. L. Maxon in making copies of descriptions and in the loan of books which I had secured at the University of California while working on *Trichomanes;* and particularly by Doctor Maxon, who provided me copies of particularly inaccessible descriptions, even such as were not in Washington.

With all this assistance, I have been able to utilize the older literature, and have been able to secure dependably authentic material of nearly all of the older species. The only considerable gaps are some rare New Zealand species, and a considerable number described in Java. As I approach the end of the work, the Third Supplement to Christensen's Index brings to attention several omissions.

The drawings are by Messrs. L. Aliebusan and E. Borbe. If the quality of their work is preserved in reproduction, any verbal praise of it is superfluous. Both came to me trained in science (professionally, Aliebusan is a plant pathologist), skilled in technical manipulation, and able to see with scientists' eyes. They have helped me, therefore, otherwise than as artists, verifying, for example, the constancy of structural peculiarities by examining long series of specimens.

Key to the subgenera of Hymenophyllum.

Stellate hairs absent.
  Receptacle indefinitely long, involucre with conspicuous tube.
    Tube obconic.
      Axes winged only in the plane of the frond. 1. *Meringium.*
      Axes bearing accessory wings..... 2. *Amphipterum.*
      Lamina consisting wholly of teeth..... 3. *Myriodon.*
    Tube cup-shaped ..... 4. *Hemicyatheon.*
  Receptacle included or nearly so, involucre deeply cleft.
    Margin toothed with sharp teeth..... 5. *Eudymenophyllum.*
    Margin entire or obscurely toothed.
      Fronds without differentiated margin..... 6. *Mecodium.*
      Fronds with black marginal strand..... 7. *Craspedophyllum.*
Stellate hairs present.
  Lamina present ..... 8. *Sphaerocionium.*
  Lamina wanting ..... 9. *Apteropteris.*

1. Subgenus MERINGIUM (Presl)

Meringium PRESL, Hymen. (1843) 116, as genus.

Involucre consisting of a distinct and well-developed tube and two large lips; receptacle slender, indefinite in length, the sporangia developing successively from the top downward, their wall cells numerous; fronds pinnate in plan, the axes (minor or all) bearing on each side a wing, one cell thick. The margin is almost always serrate, and never ciliate; the axes are usually hairy beneath; the internal cell walls are usually considerably thickened, the pattern of the thickening being in general characteristic of groups of species; without false veins.

The largest and most difficult Palæotropic group in the family. From it are derived *Amphipterum*, with accessory laminar wings, and *Myriodon*, with the lamina composed of many discrete teeth with bases elongate along the axes. With these two derived groups, *Meringium* is distinguished from all others in the family by the form of the involucre. *Didymoglossum* and *Taschneria* do, indeed, have a tube and two lips, but the lips are small, more like appendages of the tube than coördinate parts of the involucre. The indefinite receptacle is like that of *Trichomanes*, but stouter than in most trichomanoid groups. There is some resemblance between *Meringium* and the group of *Trichomanes rigidum*, in structure as well as in the receptacle.

Key to the species of the subgenus Meringium.

Margin entire.
  Axes decidedly hairy.
    Frond linear-elliptic, symmetrical. (Basilan.).... 6. *H. pulchrum.*
    Frond flabellate to lanceolate. (Malaya.).. 5. *H. pachydermaticum.*

Axes naked or slightly hairy.
Walls regularly very thick, coarsely pitted.
Rachis winged throughout. (Ceylon.).... 3. *H. macroglossum.*
Rachis terete at base. (Malaya.)..... 4. *H. penangianum.*
Walls irregularly thickened.
Frond plane. (East African islands.).... 1. *H. ricciaefolium.*
Frond somewhat crisped. (Madagascar.) 2. *H. pollenianum.*
Margin subentire. (Assam; Borneo?)..... 7. *H. edentulum.*
Margin toothed.
Frond normally 3 cm long or longer.
Rachis terete at base.
Lip of involucre entire or nearly so.
Frond distinctly red. (New Guinea.).... 33. *H. rubellum.*
Frond black. (New Guinea.)..... 34. *H. firmum.*
Frond green to brown or reddish brown.
Tube without prominent projections.
Internal walls uniformly thin. Tube, at most, marginate.
Fertile segments short. (New Zealand.) 43. *H. multifidum.*
Fertile segments normal. (New Zealand.) ..... 44. *H. bivalve.*
Internal walls thickened.
Frond deltoid, long-stipitate. (Africa.) 45. *H. triangulare.*
Axes hairy beneath.
Marginal teeth many, sharp. (Luzon.)..... 14. *H. bontocense.*
Marginal teeth few, obscure. (Fiji.)..... 37. *H. Macgillivrayi.*
Frond glabrous. (New Caledonia.) 35. *H. viride.*
Frond lanceolate to ovate.
Frond up to 5 cm long.
Frond compact. (Negros.) 13. *H. campanulatum.*
Frond lax. (Luzon.) 12. *H. bicolanum.*
Frond normally larger.
Superficial walls reticulate. (Luzon.)..... 11. *H. villatum.*
Superficial walls not pitted.
Rachis slightly hairy.
Receptacle long-exserted. (Celebes.) 10. *H. klabatense.*
Receptacle slightly exserted. (Borneo, etc.) 9. *H. Bakeri.*
Rachis decidedly hairy. (Philippines etc.) 8. *H. Meyenianum.*

Tube with conspicuous projections. (Solomon Islands.) ..... 37. *H. gorgoneum.*

Lip of involucre with short, obtuse teeth.

Frond not coriaceous.

Frond ovate. (Solomon Islands.) .. 38. *H. gorgoneum.*

Frond lanceolate. (Philippines.) ..... 15. *H. Merrillii.*

Frond coriaceous, compact. (New Guinea.) 32. *H. ovatum.*

Lip of involucre with sharp teeth.

Frond ovate.

Walls not at all toothed.

Lips coarsely toothed. (Fiji.) .. 39. *H. feejeense.*

Lips minutely toothed. (Samoa.) 70. *H. praetervisum.*

Walls somewhat toothed. (Java, etc.) 18. *H. brachyglossum.*

Frond linear-lanceolate. (New Caledonia.) 31. *H. dimidiatum.*

Rachis winged throughout.

Wing not toothed.

Frond deltoid (cf. *H. Deplanchei*). (Mindanao.) 16. *H. Ramosii.*

Frond elongate.

Frond very hairy. (New Guinea.) .... 35. *H. Foersteri.*

Frond slightly hairy. (Malaya.) .. 17. *H. holochilum.*

Wing toothed.

Wing rolled in; teeth long. (Sumatra.) 24. *H. macrosorum.*

Wing plane. (Borneo.) ..... 20. *H. Hossei.*

Wing somewhat crisped. (Malaya.) 19. *H. denticulatum.*

Wing contorted.

Stipe slightly hairy. (Malaya.) 21. *H. acanthoides.*

Stipe densely red-hairy. (Borneo.) 22. *H. carduncutus.*

Frond under 3 cm long.

Lips conspicuously toothed.

Fronds pinnate.

Walls uniformly thin. (Malaya.) ..... 26. *H. blandum.*

Marginal walls toothed. (Borneo, etc.) .... 25. *H. Lobbii.*

Frond flabellate or pinnatifid.

Walls uniformly thin. (New Zealand.) 42. *H. Armstrongii.*

Walls irregularly thickened.

Rachis with toothed wing. (Australia.) 23. *H. kerianum.*

Rachis, if any, without toothed wing.
Segments under 1 mm wide. (Borneo, etc.)
25. *H. Lobbii.*
Segments much wider. (Philippines.)
28. *H. reductum.*
Walls thickened and pitted.
With marginal setae. (Malaya.)..... 27. *H. johorense.*
With marginal teeth.
Walls much thickened. (Australia.)
41. *H. minimum.*
Walls slightly thickened. (New Guinea.)
30. *H. herterianum.*
Lips entire or slightly serrate. (New Guinea.)
29. *H. Rosenstockii.*

1. HYMENOPHYLLUM RICCIAEFOLIUM Bory. Plate 1.

Hymenophyllum ricciaefolium BORY, in Willd. Sp. Pl. V (1810) 531.
Sphaerocionium ricciaefolium PRESL, Hymen. 127.
Adiantum tenellum JACQ., Coll. Bot. 3 (1789) 287, *pl. 21, fig. 3.*
Hymenophyllum tenellum KUHN, Fil. Afric. (1868) 42, non Don (1825).
H. emersum BAKER, Syn. Fil. (1868) 457, teste 2d ed. 57.

H. frondibus bipinnatis, pinnis secundis, pinnulis inferioribus pinnatifidis, superioribus tripartitis, laciniis linearibus obtusis, soris terminalibus, indusiis obovatis, rachi alata, stipite marginato. W.

H. frondibus pinnatis, pinnulis decompositis decurrentibus, soris terminalibus. Bory in litt.

Adiantum (tenellum) frondibus bipinnatis, pinnulis lobatis, lobis oblongis. Jacq. collect. 3. p. 287. t. 21. f. 3*.

Riccienblättriger Hautfarrn. W.

Habitat in sylvis insulae Borboniae. 4 (v. s.)

Caudex repens filiformis laevis. Stipes pollicaris marginatus. Frons bipollicaris, circumscriptione oblongo-lanceolata, bipinnata. Pinnae fere semipollicares secundae. Pinnulae bilineares vel parum longiores, inferiores pinnatifidae, superiores tripartitae, summae denique bifidae, laciniis linearibus obtusis. Sori in apice frondis ad apicem laciniarum. Indusia obovata. Rachis alata. Jacquini figura, licet frondem minorem repraesentet, habitum satis bene exprimit. W.

The material available for the study of this species is very limited—two poor fronds, and the fragments accompanying the notes of van den Bosch—all in the Herbarium Lugduno-Batavum. He cites, as seen, specimens by Bory, Boivin, and Bernise from Bourbon, and Goudeot from Madagascar (Kuhn, Fil. Afric. 42, cites several more from Bourbon). I have verified his notes in the following important details: "Cellulis firmis opacis parvis imo minimis . . ., parietibus incrassatis diaphanis pulchre

minute crenulatis . . . Soris in laciniarum apicalium lacinulis terminalibus, magnis obovatis vel pyriformibus, indusio fundo conico . . ., valvis (sori totius $\frac{2}{3}$ longis) late oblongis antice plus minusve truncato-rotundatis marginibus inaequaliter crenulatis, receptaculo clavato incluso (tandem elongato exserto).—" Except that I would call the receptacle narrowly cylindrical, and believe that it is normally exserted. The walls are everywhere minutely wavy, but the beautiful crenulation is only under the upper surface. The laciniæ seem normally to be slightly crisped, or at least wavy.

The affinity is to *H. edentulum;* which (as *H. macroglossum*) is probably responsible for the citation of this species from Ceylon.

3. HYMENOPHYLLUM POLLENIANUM Rosenstock. Plate 2.

Hymenophyllum pollenianum Rosenstock in Meded. Rijks Herb. Leyden No. 11 (1912) 1.

Euhymenophyllum; rhizomate repente, filiformi, validiusculo, glabrescente; stipitibus subflexuosis, firmis, basin fere usque crispo-alatis, 2–3 cm. longis; laminis e basi parum angustata linearibus, obtusis, rigide membranaceis, fuscis, glaberrimis, subtripinnatifidis, 4½ cm. longis, 1½ cm. latis; segmentis primariis divergentibus, horizontalibus, ovatis, secundariis patulis, lacinulis linearibus, furcatis simplicibusque, valde crispatis, margine integro, apice obtuso vel acutiusculo, sinubus latis, rotundatis; rhachibus costisque crispo-alatis; soris apices frondis vel apices segmentorum summorum solum occupantibus, lacinulis haud abbreviatis insertis, mediotenus late alatis; indusiis e fundo urceolato ovalibus, ad ⅔ sori longitudinis bilobis, lobis obtusis, antice repandis vel integerrimis.

Hab. in insula Madagascar. POLLEN et VAN DAM.

Eine zwischen *H. Blumeanum* Spr. und *H. crispum* H. B. W. stehende Art mit derben Achsen und stark gekraustem Laub.—ROSENSTOCK, loc cit.

Herb. Lugd.-Bat. 911.91–28 bears the annotation label "*Hymenophyllum sp. prope H. tenellum* Kuhn. det. Rosenstock 1911," but I believe that it must be the type of *H. pollenianum*. The original label bears the collectors' names, no date, no locality more definite than Madagascar.

It is more divided and much more crisped than the specimens in hand of *H. ricciaefolium*. In their peculiar walls, the two are identical. The sori are few, and the material is so old and brittle that I have not tried to study the receptacle. The lip of the involucre is crenate. The differences from *H. ricciaefolium* are within the range of variation common with some commoner, better-known species (*H. badium, exsertum, javanicum*).

5. HYMENOPHYLLUM MACROGLOSSUM van den Bosch. Plate 3.

Hymenophyllum macroglossum VAN DEN BOSCH, Ned. Kruid. Arch. 5³ (1863) 156.

H. tenellum auct. quoad plantam Zeylanensem, non Don.

Fronde ovata bipinnatifida, laciniis primariis patulis & divergentibus contiguis imbricatisque e basi oblique cuneata rhomboideo-oblongis, secundariis contiguis erectis simplicibus (vel dichotomis) elongatis late linearibus apice rotundato integris, rhachi latiuscule alata venisque flexuosis nigricantibus, cellulis opacis mediocribus hexædris subelongatis, parietibus tenuibus crenulatis hyalinis, interaneis amorphis diffusis e flavescente rubro-fuscis, marginalibus minoribus, soris in lacinulis abbreviatis apice constrictis subexsertis majusculis, indusio elliptico angustissime alato basi conico mediotenus vel ultra bilobo, lobis dilatatis erosis, receptaculo setaceo indusio duplo longiore, stipite apice anguste alato vix ultra 2 cent. longo. Rhizoma repens parce ramosum fulvo-hirsutum, frons 3–4 centim. longa, 2 lata membranacea firmiuscula ex olivacea fusca.

Indusium a receptaculum fere sunt *Leptocionii*, sed habitu et frondis margine integerrimo nimium ab hoc recedit et, pro tempore saltem, inter *Hymenophylla* enumerandum est.

Hab. Ceylon, THWAITES N. *3360*.—VAN DEN BOSCH, loc. cit.

Twaites 3360 is in the Gray Herb.; there also is another *Twaites* specimen ex Herb. Hance *15632* labeled *H. emarginatum*; and both there and in the U. S. Nat. Herb. are fragmentary Ceylon specimen ex Herb. Ferguson, called *H. tenellum* and *H. exsertum*; in Herb. Univ. Calif. is "*H. tenellum* Kuhn," *L. G. Wall*; these, and the type fragment in Herb. Lugd.-Bat., are one species, which, regarded as endemic in Ceylon, is well definable and recognizable. It differs from *H. ricciaefolium*, and still more from *H. exsertum*, in the much thickened and coarsely pitted walls; from *H. edentulum*, in being strictly entire, and probably in being less hairy; from *H. pachydermicum* in being less hairy, and having the basal pinnæ neither reduced nor narrowed to the base. In wall structure, *H. edentulum*, *H. macroglossum*, and *H. pachydermicum* are indistinguishable.

6. HYMENOPHYLLUM PENANGIANUM Matthew and Christ. Plate 4.

Hymenophyllum penangianum MATTHEW and CHRIST, Journ. Linn. Soc. Bot. 39 (1909) 214.

Trichomanes Hosei BAKER, Journ. Linn. Soc. Bot. 22 (1887) 229. *pl. 12*: COPELAND, Philip. Journ. Sci. 51 (1933) 137, *pl. 2, figs. 2–4*; *non Hymenophyllum Hosei* Copel. (1917).

Hymenophyllum semifissum COPELAND, Philip. Journ. Sci. 10 (1915) Bot. 145; CHRISTENSEN, Gardens' Bull. S. S. 4 (1929) 376.

Hymenophyllum leptocarpum COPELAND, Brittonia 1 (1931) 71.

A cause de son réceptacle sortant de l'orifice de l'urcéole, cette èspèce paraît de prime bord appartenir au genre *Trichomanes*. Mais l'ensemble de la plante, son tissu fort mince, olivatre, et l'indusie non campanulé, mais ovale, la rougent plus naturellement parmi les *Hymenophyllum*. Le port est celui d'*H. lineare* d'Amérique ou d'une èspèce voisine, mais la plante est lisse, sauf quelques rares poils de la rachis.

Rhizomate filiformi repente ramoso breviter tomentoso. Foliis sparsis sed caespitoso-approximatis. Stipite nigro filiformi sed rigidiusculo pubescente 2 cm. longo. Fronde oblongo-ovato basi attenuato usque ad 7 cm. longo, 2 cm. lato. Rachi pilosa usque ad mediam laminam libera supra alata. Fronde pinnata usque ad bi-imo tripinnatifida, pinnis erecto-patentibus alternis, 6 ad 8 utrinque, inferioribus remotis, costa alata, usque ad 2 cm. longis, 9 mm. latis, oblongis, pinnulis 8 utrinque, inferioribus bi-aut trifidis, lobis ultimis obtusis 2 ad 3 mm. longis, 0.75 ad 1 mm. latis obtusis integris, nervis nigris conspicuis. Soris praecipue in axillis pinnarum antice, rarius in apice lobrum superiorum positis, semiinsertis, ovatis, 1.5 mm. longis, valvis duabis manifestis semiovatis subintegris, receptaculo crasso exserto. Textura tenui diaphana, colore olivaceo, soris obscurioribus.

Hab. Penang, Government Hill, 2000 ft., Dec. 27, 1906; I. C. G. Matthew, 90.

The identity of the four "species" combined here is complete. I have not seen the original collection of *H. penangianum*, but *Holttum-Singap. Field No. 20998*, identified by Holttum, is from the type locality and fits the description well. I have already illustrated *T. Hosei* from a cotype (Trichomanes, pl. 2, figs. 2–4). For convenience, and to show the perfect identity, I illustrate it here using the type of *H. semifissum*.

Specimens: PENINSULA, *Holttum-Singap. Field Nos. 20998, 20565*. BORNEO, *Charles Hose 733, Brooks and Hewitt s. n., Bur. Sci. 2607 native collector* (type of *H. semifissum*), *Clemens 22018* (type of *H. leptocarpum*).

This species has been referred with professed confidence to both *Trichomanes* and *Hymenophyllum*. I refer it now to the latter, because it is without near relatives in *Trichomanes*, but is very evidently related to a large group here construed as *Hymenophyllum*. Specifically it may be nearest to *H. macroglossum*. The group as a whole may best be removed from both genera; when that is done this species can recover its oldest specific name.

6. HYMENOPHYLLUM PACHYDERMICUM Cesati. Plate 5.

Hymenophyllum pachydermicum CESATI, Atti Accad. Napoli 8 (1876) 8.

Hymenophyllum vestitum BAKER, Kew Bull. (1894), *teste* CHRISTENSEN, Gardens' Bull. 7 (1934) 213, non van den Bosch (1863).

Hymenophyllum halconense COPELAND, Philip. Journ. Sci. § C 2 (1907) 144.

Hymenophyllum taliabense V. A. VAN ROSENBURGH, Bull. Jard. Bot. Buitenzorg II No. 16 (1914) 18.

Hymenophyllum pilosum V. A. VAN ROSENBURGH, Bull. Jard. Bot. Buitenzorg II No. 16 (1914) 57.

Hymenophyllum Clemensiae COPELAND, Philip. Journ. Sci. § C 12 (1917) 46.

Dense caespitosum, rhizomate tenuissimo intricato, rufo-setuloso praesertim ad bifurcationes noduloso, stipites pariter tenues, apteros, plus minus setulosos, 1-3 centimetra longos emittente, abeuntes in rondem oblongam vel lanceolatam (si sterilis sit, subflabellatam brevem et aequilatam), duo decimetra longam, unam vel unum et semis latam, subtus rufo-hirtellam, copiosius ad nervos, pilis articulatis, bipinnatifidam. Laciniae planae, obovatae, lineares, obtusae vel truncatulae, lobulis 3–5, in frondibus sterilibus ad apicem densius barbatis. Cellulae parvae, obtusangulae, obscure hexaedrae vel subrotundatae, parietibus sinuosis incrassatis ad typum cellularum ambiomorpharum Mettenii (in icone 35, tab. III, ejus dissertationis "*Über die Hymenophyllaceae*", p. 445, expressum), limbo interaneo lato turbido, centro hyalino; marginales magis quadratae, hinc inde singulis omnino opacis intermixis. Sori alares immerse elliptici, indusii tubo complanato, labiis ovatis acutis dimidium tubum metientibus, receptaculo filiformi duplo longiori.

Sarawak, in M. Gunong Poe.—Mese d'agosto 1866.—CESATI, loc. cit.

The description of the fronds as 2 dm long is an obvious misprint, for 2 cm. Fertile fronds seen vary in length from 1.5 to 6 cm. They are commonly a scant 2 cm wide, on stipes hardly that long and winged near the top or almost throughout; rachis winged, usually not very narrowly, the wing entire, rachis and ribs densely beset on the back with rusty to fuscous, somewhat deciduous hairs; pinnæ proximate, pinnatifid, with mostly simple, entire segments a scant millimeter wide, the lowest pinnæ usually reduced and (unless simple) with cuneate bases; internal cell walls very much thickened, and coarsely pitted, appearing coarsely and rather regularly toothed in optical section; sori on shortened lowest acropetal segments of pinnæ above the middle of the frond, involucre immersed or nearly free at the base, about 1.5 mm long, cleft about halfway down, tube hairy on the back, lips variable, usually broadly rounded and entire but sometimes narrowed, or emarginate, or very obscurely toothed, receptacle exserted.

Specimens: BORNEO, *Beccari* (type collection, Mount Poe), *Brooks 164, Clemens 10780* (type of *H. Clemensiæ*), *10226, 22173, 29270, 50667, Topping 1619, Holttum Singap. Field No. 25618.* SUMATRA, *Matthew 681* (type coll. of *H. pilosum*), *Bur-*

chard 119. SULA-TALIABO, *Atje 216* (type coll. of *H. taliabense*). PHILIPPINES, *Merrill 6084* (type of *H. halconense*), *6085*, *Bur. Sci. 28412*, *38769*, *F. B. 12107*. Van Alderwerelt has described a variety *nirmalanum* of his *H. pilosum*, from Java. From Sumatra there is a very ample series of specimens ex Herb. Waitz in Herb. Lugd.-Bat., which Rosenstock identified by description as *H. pedicularifolium* Ces. They fit fairly what there is of a description of that species; but, because it was described from as far away as Papua, and because they do represent another of Cesati's species, I do not accept the identification. They are *H. pachydermicum*.

I have in hand the type collections of all the "species" here combined (except the untenable *H. restitum*). *Hymenophyllum pachydermicum*, *H. taliabense*, and *H. Clemensiæ* are identical. *Hymenophyllum halconense* has longer and laxer fronds, and *H. pilosum* has rather less extremely thickened walls; but these distinctions do not look diagnostic.

Hymenophyllum macroglossum, of Ceylon, has apparently less hairy fronds, with broader base. *Hymenophyllum pulchrum* is a local derivative with more ample, conspicuously symmetrical fronds. *Hymenophyllum edentulum* has the segments not quite entire. My only puzzle as to the name of the Bornean plants is founded on doubt as to the validity of this distinction from *H. edentulum*.

6. HYMENOPHYLLUM PULCHRUM Copeland sp. nov. Plate 6.

Rhizomate filiforme vix 0.2 mm crasso, intricato, piloso vel glabrescente; stipite 1.5 ad 3 cm longo, filiforme, sursum alato; fronde ca. 6 cm longa, 2 cm lata, anguste elliptica, fusca, bipinnatifida, rhachi late alata venisque inferne dense pilosis; pinnis late decurrenti-adnatis, oblongis, ca. 1 cm longis, 6 mm latis, oblique inciso-pinnatifidis, segmentis 1 ad 3 mm longis, 1 mm latis, apice rotundatis, integris; cellulis paullo elongatis, saepe rectangulis, parietibus apud superficiem primo minute crenulatis vel angulosis demum ibidem rectius incrassatis lineas angustas parietis externalis incrassatae emittentibus; soris axillaribus basi vix immersis, tubo 1 mm longo anguste alato, inferne piloso nigro, labiis brevioribus late triangularibus obtusis, receptaculo gracile exserto.

BASILAN (prope Mindanao), *Bur. Sci. 16214 Reillo*, September 8, 1912. Type in Phil. Nat. Herb.

A member of the group of *Trichomanes Hosei*, *Hymenophyllum edentulum*, etc., which, except for the hairiness (beneath) of rachis, veins, and involucre, I would suspect of being *H. ringens*.

The symmetry of the fronds and the uniformity of the closely placed pinnæ give this little fern a pleasing appearance.

68. HYMENOPHYLLUM BATUENSE Rosenstock.

Hymenophyllum batuense ROSENSTOCK, Bull. Jard. Bot. Buitenzorg II No. 2 (1911) 22.

? Leptocionium; *rhizomate* tenui, repente, radiculoso, piloso; *stipitibus* tenuibus, teretibus, fusco-pilosis, sursum angustissime alatis, 1–1½ cm. longis; *laminis* oblongo-lanceolatis vel linearibus, olivaceis, c. 6 cm. longis, 2 cm. latis, bipinnatifidis; *pinnis primariis* lineari-oblongis, suberectis, subcontiguis, ala angustissima rhacheos inter se conjunctis, vel basalibus liberis, summis simplicibus furcatisve exceptis pinnatifidis, maximis 2 cm. fere longis, 7 mm. latis; *lacinulis* linearibus, apice retuso, integro, simplicibus vel basalibus furcatis, oblique porrectis, subparallelis, planis, integerrimis, 3 mm. fere longis, 1 mm. latis; *rhachibus* tenuibus, deorsum angustissime, sursum latius alatis, cum *costis* pilis fuscis subtus aspersis; *venulis* sub angulo 45° exeuntibus, longe ante apicem desinentibus; *soris* lacinulas basales pinnarum vix abbreviatas, infra sorum plerumque sinuato-angustatas, terminantibus, laciniis angustioribus e basi anguste conica elongato-oblongis, utrinque usque ad mediam marginatis, nudis vel raro basi appendiculatis seu indistincte cristatis, usque ad dimidiam fere bilabiatis; *labiis* elongato-triangularibus, productis, integerrimis vel apice minute crenulatis; *receptaculo* exserto, valido, incurvato, soro duplo fere longiore.

Hab.: Insel *Batu*, L. Raap No. 579.

'Die Art hat grosse Ähnlichkeit mit einem weniger stark geteilten *Leptocionium kalochilum* v. d. B., doch ist der Blattrand völlig ungezähnt. *H. edentulum* v. d. B., das einem *fast* ungezähnten Blattrand besitzt und hierdurch unsrer Art nahe steht, ist stärker geteilt, trägt mehrere Sori am Vorderrand der Fiedern und seine Indusien sind breiter und stehen auf längeren Lacinien.—ROSENSTOCK, loc. cit.

This species seems to belong in a group with the six preceding species, but, without seeing it, I cannot place it more exactly. It is antedated by all except *H. pulchrum* from which it seems to differ conspicuously by having a very narrowly winged rachis.

69. HYMENOPHYLLUM HALLIERII Rosenstock.

Hymenophyllum Hallierii ROSENSTOCK, Bull. Jard. Bot. Buitenzorg No. 2 (1911) 23.

? *Leptocionium; rhizomate* validiusculo, lignoso, repente, glabrescente; *stipitibus* remotis, ad 5 cm. longis, usque fere ad basin distincte alatis; *laminis* c. 12 cm. longis, 3 cm. latis, oblongo-lanceolatis, sursum longe attenuatis, obscure olivaceis, glabris, subtripinnatifidis; pinnis primariis inframedialibus maximis, ad 3 cm. longis, 1–1½ cm. latis, suberectis, ovato-lanceolatis, apice incurvatis, inferioribus ac superioribus simplicioribus, summis furcatis vel simplicibus; *pinnis secundariis* inferioribus recte patentibus vel paullo recurvis, flabellatim bipinnatifidis, ceteris obliquis et simplicioribus; *lacinulis ultimis* linearibus, apice rotundato emarginato; *rhachibus* cum *costis* subflexuosis, late alatis, glaberrimis; *venulis* vali-

diusculis, angulo acutissimo exeuntibus, sub emarginationem apicis desinentibus; *soris* lacinulas abbreviatas terminantibus, e basi conica subcylindricis, utrinque late alatis, usque ad ⅓ longitudinis bilabiatis; *labiis* ovato-triangularibus, acutis; *receptaculo* exserto, incurvato, soro duplo fere longiore.

Hab.: *Borneo*, l. Hallier No. 1791 ex p.

Auch diese Art würde zweifellos zur Leptocionium-Gruppe zu zählen sein, wenn ihr Blattrand auch nur eine Spur von Zähnelung zeigte. Durch das kurzlippige Indusium steht sie dem *Leptocionium Presli* v. d. B. nahe, das sich ausser durch gezähnten Blattrand durch weit schwächere Achsen und weniger weitgehende Teilung der Lamina unterscheidet.

—ROSENSTOCK, loc. cit.

This species also seems properly to be grouped with the preceding one, and most to resemble *H. Lobbii*, but apparently distinctly larger, the fronds being about 12 cm long. I have not seen it.

7. HYMENOPHYLLUM EDENTULUM Christensen. Plate 7.

Hymenophyllum edentulum (van den Bosch) CHRISTENSEN, Index (1905) 360.

Leptocionium edentulum VAN DEN BOSCH, Ned. Kruid. Arch. 5' (1863) 148.

Fronde e basi lata rotundata ovata vel ovato-oblonga sursum angustata bipinnatifida, laciniis primariis patulis (infimis divergentibus) subcontiguis ovatis oblongisve apice adscendentibus, secundariis patulis remotiusculis dichotomis vel simplicibus (infimis pinnatifidis) lacinulis linearibus elongatis approximatis planis apice integro, margine dentibus parvis remotis obsito vel sub-integro rhachi flexuosa anguste marginata, inferne subteretc, venis venulisque strictis nigrofuscis, cellulis opacis mediocribus, hic illic magnis hexaëdris acutangulis, parietibus pulchre spinuloso-dentatis hyalinis incrassatis, interaneis amorphis diffusis spissiusculis sordide olivaceofuscidulis, marginalibus minoribus semi-hexaëdris pariete exteriore minute crenulato, soris in laciniis secundariis lateralibus in lacinula parum abbreviata immersis mediocribus, indusio lacinulae latitudini aequali elliptico turgido mediotenus bifabiato, labiis integris vel obsoleto denticulatis, receptaculo setaceo tandem exserto, stipite filiformi terete 1½–2½ cent. longo. Rhizome filiforme repens radiculosum glabrescens, frons 4–5 centim. longa, 2–2½ lata membranacea diaphana firmiuscula ex olivaceo fusca.

In speciminibus Assamicis denticuli marginales in lacinulis junioribus tantum conspiciuntur, indusii labia iis sunt integra; Borneensium denticuli in utraque parte evidentiores. Reliquis characteribus optime inter se conveniunt.

Hab. Assam, *Griffith;* Borneo (pr. Sarawak) *Th. Lobb* (H. Hook.).

—VAN DEN BOSCH (1863) 148.

This species will have to be studied at Kew before it can properly be understood. The Herbarium Lugduno-Batavum contains sterile fragments of the *Griffith* plant, but none of *Lobb's*. The pencil sketches, showing very evident marginal teeth and

denticulate lips, would seem to represent the latter. It seems, too, that van den Bosch had been in doubt as to the identity of the two. From one of the fragments I would think the lower part of the rachis was really terete. The walls are thickened to excess and coarsely pitted, as in *H. macroglossum*, *H. pachydermicum*, and related species. Except that *H. pachydermicum* is strictly entire, I would suppose it to be the Bornean component of *H. edentulum*.

Because I cannot see why they are not this species, rather than because I am sure that they are, I refer to *H. edentulum* specimens from the extreme north of the Philippines: *Bur. Sci. 28412, 33384, 78692, 78703, 78707, 78721, 78730,* and *80150;* the last has less-robust wall teeth, thus suggesting *H. Bakeri*, and, less immediately, *H. Meyenianum*.

I have felt out the propriety of making *H. edentulum* include *H. Bakeri, H. macroglossum, H. pachydermicum,* and *H. penangianum;* but have decided that the first is too different in the thickening of the walls, and that it is best to regard an entire margin as specifically distinct from one with even few and obscure teeth. It is certainly true, however, that this distinction, of general subgeneric value while *Hymenophyllum* has its present scope as a genus, is at most of specific value in this group. Of the small ferns with considerably thickened and toothed (pitted) walls, *H. edentulum* follows *H. ricciaefolium* and *H. holochilum* in priority of name.

6. HYMENOPHYLLUM MEYENIANUM (Presl) Copeland comb. nov. Plate 8.

Meringium Meyenianum PRESL, Hymen. (1843) 116, pl. 8, B.
Trichomanes Meyenianum VAN DEN BOSCH, Synopsis (1859) 30.
Hymenophyllum serrulatum (Presl) CHRISTENSEN, Index (1905) 367.
Didymoglossum serrulatum PRESL, Hymen. (1843) 115 *nomen*, 140.
Leptocionium serrulatum VAN DEN BOSCH, Synopsis (1859) 43.
Hymenophyllum bivalve J. SMITH, Hooker's Journ. Bot. 3 (1841) 418, *non* Swartz.
Hymenophyllum Smithii HOOKER, Sp. Fil. 1 (1844) 97, pl. 35B.
Leptocionium Preslii VAN DEN BOSCH, Synopsis (1859) 44.
Leptocionium violaceum VAN DEN BOSCH, Ned. Kruid. Arch. 5[2] (1863) 147.
Hymenophyllum violaceum MEYEN, ibid., synonym.

Presl embodied the specific description in that of his genus *Meringium*, which follows:

Venae alternae, pinnatim ramosae venulisque subprominulae et apice libero desinentes. Sorus lateralis, subpedicellatus, basi bibracteatus. Indusii tubus breviter campanulatus, limbo bipartito, laciniis late ovatis obtusis

concavis demum divaricato-patentibus. Capsulae lenticulares, parti inferiori receptaculi filiformis crassiusculi indusio longioris affixae, sessiles.

Rhizoma repens, ramosum, filiforme, ramisque radicibusque paleis piliformibus horizontalibus rufis hirsutum. Stipes duos—semitertium pollicem longus, teres, paleis piliformibus flexuosis patentissimis vel divaricatis hirsutus, demum glabrescens. Frons (limbus) fusco-purpurea, tres-quatuor pollices longa, oblonga, basi nempe angustior quam versus apicem, pinnata, pinnis alternis petiolulatis lanceolatis acutis profundissime pinnatifidis vel si mavis pinnatis, in uno latere frondis majores quam in altero, laciniis vel pinnis secundariis sublanceolatis obtusis quinque-quadri-tri-bilobis, lobis linearibus obtusis angulo acuto interstinctis apicem versus argute serrulatis, infimis superioribus pinnularum superiorum in soros obliteratis et ita angustis ut pedicellum brevissimum mentiantur. Sorus ergo lateralis seu apparenter lateralis, subpedicellatus, multo major quam in Didymoglossi speciebus, basi bracteis duabus oppositis linear-lanceolatis acutis serratis adpressis tubo indusii aequilongis instructus. Indusii tubus breviter campanulatus, limbus tubo duplo longior, profunde bipartitus, laciniis late ovatis rotundato obtusis concavis patentibus demum divaricato-patentibus. Receptaculum indusio triplo fere longius, filiforme, rigidulum, quemadmodum in Trichomanis paragrapho tertia Pachychaetum dicta crassiusculum, cicatriculis spiraliter ambientibus sub lente composita visum instructum, rectum vel curvatum. Capsulae in inferiori parte receptaculi affixae, lenticulares sessiles.

Non negandum, hocce genus Didymoglosso affine esse, differt tamen praecipue indusio, cujus tubus brevis campanulatus nec cylindraceo-tubulosus, et cujus limbus profunde bipartitus, laciniis latis concavis demum divaricatis, nec laciniis tubo duplo brevioribus ovatis planis demum patentibus; demum differt receptaculo crassiusculo basi capsulas globoso-congestas gerente.—PRESL, op. cit. 116.

There is no doubt about the synonymy. After deciding it, and writing it up, I discover, *Herb. Lugd.-Bat. No. 910, 28-6*, an unpublished synonymy by van den Bosch, listing, under a name invalid and never published, the following synonyms: *Hymenophyllum Smithii* Hooker *quoad Cum. N. 164; H. violaceum* Meyen. in Herb. Berl.; *Meringium Meyenianum* Pr.

This is one of the commonest species of the Philippine mossy forest. Its distinctive characters are persistently setose stipe and rachis, the latter mostly winged but without teeth on the wing, dark brown lamina, segments more or less 1 mm wide, remotely and finely toothed, the axils webbed so that there is more or less uncut lamina from which the pinnules and segments spring, internal cell walls little thickened in the median plane of the lamina but much modified at the surface, involucre hairy at base, otherwise smooth or with inconspicuous longitudinal basal ribs, lips entire, receptacle stout, long-exserted.

Rhizome wide-creeping, densely hairy; stipe 3 to 5 cm long, dark, slender but firm; well-grown fronds commonly up to 10

cm long and 5 cm broad; pinnæ ovate to lanceolate, the lowest usually subopposite, reduced or not reduced; segments with one vein 0.7 to 1.3 mm wide; in correlation with the characteristic webbing of the axils, two veins may run to the end of an undivided segment, which is of course correspondingly broad. The teeth are very variable. Often a single cell constitutes a minute tooth, or one cell may rest on a base of two cells. Often the two cells rest on three; this may be regarded as the tooth most characteristic of the species. An aculeate tooth, with a series of more than two cells at its tip, is exceptional. The teeth are closest at the apices of segments, and may be forcipitate, bent together towards the apex. Away from the apex they become remote or disappear.

The thickening of the walls is variable and interesting. In the median plane of the lamina, the walls are more or less straight, and either thin or, less commonly, nodulose-thickened. When they present the latter appearance in optical section, the real condition is that they are reticulate-thickened, coarsely so, considering the dimensions of the cell. The area surrounded by a thickened line is a pit, although much broader than deep. A pit can occupy the whole height of the wall, but more commonly two or three of them do so. Exceptionally, no thickening at all occurs in the middle plane; this is the rule in *H. klabatense*, and is commoner in specimens from New Guinea and Mindanao than in the central area of the species—Luzon and the Visayan islands. Approaching both surfaces, the young wall is often but not always either finely crenulate or zigzag. The whole wall thickens there with age; and, if it is wavy or zigzag, thickened lines are formed along the inner face of the superficial walls, projecting from the original points or convexities. These look like teeth projecting from the lateral walls, and can be so called. If they always originated from the points just mentioned, they would necessarily be placed alternately on the opposite sides of an inner wall, which is by no means always the case. They are formed normally in all cells, whether or not the internal wall was originally straight. They project inward from the marginal walls, which of course were never crenulate or zigzag. The internal walls as a whole undergo less thickening than in the related group of *H. edentulum;* and the teeth are more slender, the pits correspondingly broader and shallower.

The thickened lines on the superficial walls are the beginning of a system of pits like that on the internal walls. Usually even the border pits are never inclosed; but sometimes the thick-

ened lines branch and more or less complete the formation of a row of pits around the cell. Rarely, they grow still farther: and very rarely the entire superficial wall of single cells becomes reticulate. Submarginal cells are most likely to develop in this fashion.

If not very numerous, the sori are produced in the axils of the lowest acropetal pinnules, or in the axils of otherwise simple or nearly simple pinnæ at the apex of the frond. In very full fruit, they occur in the axils of succeeding pinnules. They are sessile, wingless or winged for a short distance on the side towards the pinnule. The involucre is 2.5 to 3 mm long, 1.3 to 1.5 mm wide at the top of the tube, and cleft about halfway down, sometimes farther, very solid in texture. The tube is deciduously hairy at the base, and usually bears there about three very inconspicuous, short, longitudinal ribs (like those of *H. holochilum*). Each side bears a strong rib. As rare exceptions, various folds or projections are found on the tubes of individual sori; such structures may have been responsible for the "two opposite bracts" described and figured by Presl, who has been charged more than once with pure imagination in such details. The entire lips are broadly rounded, or more often narrowed to an obtuse point. Old and uninjured receptacles are likely to project by the length of the involucre.

Specimens: PHILIPPINES, *Cuming 321* (type collection of *H. serrulatum* in Gray Herb. and Phil. Nat. Herb.), *264; Bur. Sci. 5137, 9876, 9842, 13437, 14806, 14809, 14822,*[1] *14874, 15347, 19595, 19621, 25768, 29057, 29701, 35699, 35733, 35755, 37846, 38080, 38930, 41907, 43042, 45632, 47439, 48566, 48655, 48659, 76539, 76542, 76543; F. B. 4659, 7776; 7955, 7967; Clemens 17303, 17304; Elmer 6801, 7793, 9818, 9910a* (fronds up to 20 cm long and 8 cm wide), *12392; Whitford 165, 443, 918, 1509, 1511; Merrill 3233, 7489, 7498; Copeland 208; Topping 454, 820; Loher 13517; McGregor s. n.; Weber 1448.* NEW GUINEA. *Bamler s. n.* (*Rosenstock Fil., novoguin. exs. n. 342*), *Bamler 50d* (var. *cristulatum* Rosenstock), *Bamler s. n.* (*Ros. 209*, var. *cristulatum f. minor.*

The three *Bamler* collections from New Guinea are too alike to need naming as varieties or forms. They are not quite typical *H. Meyenianum*, being less hairy, with somewhat more-

[1] In Phil. Nat. Herb. In U. S. Nat. Herb., this number is *H. denticulatum.*

prominent teeth, and less-developed wall thickenings, but are within the range of variation in the Philippines.

Typical *H. meyenianum* has a definitely limited range within the Philippines. From Bontoc, south, it is typical. From north of Bontoc we have one specimen, *Eur Sci. 39305*, from Ilocos Norte, macroscopically typical, but with only a suggestion of the typical wall thickenings. From Mindanao there are few enough specimens to indicate rareness and none of them is quite typical. From Palawan the only similar specimen belongs to the Bornean race, which I prefer to hold distinct, as *H. Bakeri*.

Some affinity of *H. Meyenianum* to the group of *H. edentulum* may be postulated with confidence. It is especially related to *H. holochilum*. On the other hand, I mistrust any near connection with *H. multifidum*, although that species has been credited to Papua and Celebes, and even Philippine specimens have been given that name.

9. HYMENOPHYLLUM BAKERI Copeland.

Hymenophyllum Bakeri COPELAND, Sarawak Mus. Journ. 2 (1917) 309; CHRISTENSEN, Mitt. Inst. Bot. Hamburg 7 (1928) 143.
Trichomanes denticulatum BAKER, Syn. Fil. (1867) 82, non Houtt. nec Poir.

Rhizome slender, wide-creeping; st. slender, naked, ¼–½ in. l.; fr. 1–1½ in. l., ½ in. br., ovate or oblong, bipinnatifid, main rachis winged above, free below; pinnae pinnatifid down to a narrowly-winged rachis; ultimate segment linear, serrated, about ⅔ in. l., ⅛ in. br.; texture membranaceous; a costa only in each segment; sori 1 to a pinna, terminal on the lowest segment on the upper side, tube exserted, mouth with two bluntly triangular lips.

Hab. Borneo, discovered by the late Mr. Motley.—An interesting plant, combining the habit of *H. Tunbridgense* with the fruit of a *Dalymoglossum*.—BAKER, loc. cit.

I ran the most classic of risks in giving a name to this species without having seen an authentic specimen. Christensen has consulted Baker's type, and says: "*H. Bakeri* ist mit *H. microchilum* sehr nahe verwandt, weicht aber ab durch die gesägten segmente." Perhaps I misconstrue one of these species, for I do not detect the affinity. I have from Doctor Christensen his var. *funebre*, which seems to be a form of the species I had in mind when giving the name, then represented in local herbaria by *Eur. Sci. 1523 native collector*.

This is in general a smaller fern than *H. Meyenianum*, with less hairy and very slender rachis, and narrower segments, and different structure of walls, but clearly related to that species.

and taking its place in Borneo, Palawan, Sumatra, and the Peninsula. It can reach the usual stature of *H. Meyenianum*, but 6 cm is a commoner length of frond, and it may be still smaller. The walls are only slightly thickened, broadly wavy where they come to the surface, with a long, narrow, thickened line running out from each convex curve or angle; in this way, each cell, in surface view, is bordered by a row of large, three-quarters-inclosed areolæ; and it is not rare for the areolation to be more complete and extensive. The sori are usually small, involucre cleft more or less halfway down, tube slightly, deciduously hairy on one side, otherwise smooth, lips rounded, entire, receptacle eventually exserted, but seldom visible.

Specimens: BORNEO, *Burbridge, Bur. Sci. 1523 native collector, Hewitt 34, Brooks 166, 175, Clemens 10779, 29005, Winkler 1043b, Native collector Sarawak Mus. 6.* MALAY PENINSULA, *Wray 3693, Holttum 18078, 19916, 19931, 20085, 20641, Henderson 18819B,* "State of Pahang" *13939.* SUMATRA, *Winkler, Ros. Fil. Sumat. 209, Barlett 7972.* PHILIPPINES, *Bur. Sci. 14809, 14822, Wenzel 959, Merrill 9517.*

16. HYMENOPHYLLUM KLABATENSE Christ.

Hymenophyllum klabatense CHRIST, Verh. Nat. Ges. Basel 11 (1894) 4.

Hymenophyllum multifidum CHRIST, Ann. Jard. Bot. Buitenzorg 15 (1897) 98.

As Christ's original publication is hardly in form a diagnosis, I describe the plant from the specimens in hand and present here his comment when, in error, he reduced it to *H. multifidum:*

"Form mit kurzen und seltenen Zähnen des Blattrandes, weit zurückstehend an Entwickelung hinter den Ex. Neuseelands. Die Gipfelform ist kleiner." *Koorders 17136.*

The Herb. Lugd.-Bat. contains *Koorders 17136* (det. Christ) and four sheets in Herb. Waitz without other data than the place of collection, the summit of Mount Klabat.

Stipe 5 to 8 cm long, firm, deciduously hairy; frond 8 to 14 cm long, 3 to 5 cm wide, tripinnatifid, rachis winged nearly to the base, sparsely pilose; segments about 0.7 mm wide, 5 mm long, remotely and finely serrulate; internal walls thin and nearly straight in the middle plane, minutely crenulate, or when old finely toothed at the surfaces by short thickened streaks of the superficial walls; sori in the axils of the lowest acroscopic pinnules, sessile, hardly at all winged, involucre 2 mm long, 1 mm wide, cleft nearly or quite halfway down, tube hairy at base.

eventually smooth or with 2 or 3 short, obscure ribs, lips entire, obtuse, receptacle stout, much exserted.

Specimens: CELEBES, as already cited. MINDANAO, Mount Apo, *Copeland 1058*.

Hardly more than a local form of *H. Meyenianum* with less hairy axes, thinner walls, and narrower segments than are usual in that variable species. Not near to *H. multifidum*, to which it has been reduced, probably because of its narrow segments. Still less, of course, related to *H. polyanthos*, *H. badium*, and *H. javanicum*, with which Christ had previously compared it.

11. HYMENOPHYLLUM VITTATUM Copeland sp. nov. Plate 9, figs. 1 to 3.

Rhizomate 0.4 mm crasso, late repente, piloso; stipite 1 ad 2 cm alto, sursum rhachique anguste alatis haud dense pilosis; fronde 5 ad 6 cm longa, 2.5 ad 4 cm lata, fusca, vix tripinnatifida; pinnis ovato-lanceolatis, obtusis, pinnulis plerisque furcatis, segmentis 2 ad 3 mm longis, ca. 0.7 mm latis, obsolete serrulatis; cellulis paullo elongatis; parietibus laxe reticulatis, reticulatione superficiem totam saepe ornatim tegente; soris in parte superiore frondis ad pinnulas' vel rarius pinnulas" infimas plus minus abbreviatas seriatis, basi vix immerso, involucro 2 ad 2.5 mm longo, 1 ad 1.2 mm lato, medio fisso, tubo nudo ad basin interdum inconspicue striato, labiis integris, receptaculo valde extruso.

LUZON, Tayabas Province, San Antonio, *F. B. 13099 Curran*, (type in Phil. Nat. Herb.); Laguna Province, Dalican, San Antonio, *Bur. Sci. 10038 Ramos*.

The two collections are from approximately the same place, possibly from different sides of a provincial boundary.

This is a local derivative of *H. Meyenianum* from which it differs in its short stipe, less hairy axes, fewer teeth, rather narrower involucres, and more freely reticulate superficial walls. Some segments are quite entire.

12. HYMENOPHYLLUM BICOLANUM Copeland sp. nov. Plate 10.

Rhizomate intricato vix 0.2 mm crasso, subglabrescente; stipite 1 ad 2 cm alto, gracillimo, mox nudo; fronde usque ad 5 cm longa, 1.5 cm lata, fusco-viride, bipinnatifida, laxa, rhachi (nisi prope apicem) tereta, nigra, sparse pilosa; segmentis remotis, 3 ad 6 mm longis, 0.4 ad 0.6 mm latis, remote spinuloso-serrulatis; parietibus cellularum internalibus fere rectis tenuibus, obscure noduloso-incrassatis, hic ubi ad superficiem attingunt sinuato-crenulatis tantum irregulariter incrassatis et inconspicue denticuliferis; soris in locis segmentorum abbreviatorum infimorum pinnarum superiorum, 1.5 ad 2 mm longis, obovatis,

involucro vix ad medium fisso, tubo cuneato basi vix immerso inferne subnudo superne nudo, labiis late rotundatis, integris v. subintegris, receptaculo tantum exserto.

LUZON, Camarines Sur Province, Mount Isarog, altitude 1,200 to 1,500 m, *Bur. Sci. 70555 Edaño* (type in Phil. Nat. Herb.), *Bur. Sci. 70537, 70549 Edaño.*

Possibly referable to this species is a single collection from Catanduanes, altitude 30 m, with narrower and more compact fronds and less salient teeth, differences perhaps due to the environment.

A dwarf relative of *H. Meyenianum*, from which, besides in size, it differs in extreme slenderness and relative nakedness.

13. HYMENOPHYLLUM CAMPANULATUM Christ. Plate 11.

Hymenophyllum campanulatum CHRIST, Philip. Journ. Sci. § C 2 (1907) 155; *non* REINWARDT in van den Bosch, Hymen. Javan. (1861) 17, *nomen nudum*.

Leptocionium. Habitu omino *H. Tunbridgensis*, valvis integris, rhachi hispida.

Dense et late caespitosum, rhizomate tenui sed rigido ramosissimo, stipite rhachique nigris pilis rigidis hispidis, stipite 1.5 cm. tenui, fronde 4 cm. longa 1 cm. lata bipinnatifida oblonga, basi et apice attenuata, pinnis ca. 6 utrinque arcuato-reflexis, alternis, 1 cm. longis, flabellato-partitis, laciniis 4 aut 5, linearibus, vix 1 mm. latis, parce aristato-serratis. Soris raris, prope basin costae positis, pedunculatis, campanulatis, valvis erecto-patentibus ovatis, 2 mm longis. Textura rigidiuscula. Colore fusco.

NEGROS, [Occidental Negros Province], Mount Silay, (1549) *Whitford* May, 1906, alt. 1,100 m.—CHRIST, loc. cit.

The cotype in the Philippine National Herbarium seems to contain only two sori, on one frond, in a dense mat of sterile fronds.

Christ's description is accurate, as far as it goes, except as to size of sorus. The pubescence is sparse, of fuscous hairs; rachis terete below, narrowly winged upward; segments remotely and obscurely toothed. The walls are of the type of *H. edentulum*, but the thickening and toothing are only incipient. The sori (judging by those seen) are in the axils or places of the lowest acropetal pinnules, and sessile; involucre 1.5 mm long, split halfway down, with ovate, rounded valves; tube naked and smooth except for some deciduous hairs on the dorsal surface at the base, receptacle extruded. Although the tube is turgid, such an involucre is in no proper sense campanulate, wherefore I suspect that, though the whole description is of this *Hymenophyllum*, the name is due to the presence of fertile *Trichomanes parvulum*.

Besides the type collection, this species is represented by *F. B. 13605* and *13643*, also from Negros.

14. HYMENOPHYLLUM BONTOCENSE Copeland sp. nov. Plate 12.

Rhizomate ad truncos muscosos intricato, 0.2 mm crasso, glabrescente; stipite aequigracile, 1 ad 2 cm alto, piloso sed glabrescente, terete vel sursum marginato; fronde usque ad 6 cm alta, 2 cm lata, bipinnatifida, rhachi sursum anguste alata deorsum tereta vel marginata, inferne sparse setosa, segmento primo acroscopico saepe furcato; segmentis plerisque 1 mm latis, 3 ad 5 mm longis, minute argute serratis; parietibus cellularum plerisque tenuibus rectis, rarius denticulationem incipientem tantum monstrantibus; soris in locis pinnarum superiorum vel pinnularum primarum, involucris 3 mm longis, 1 ad 1.3 mm latis, medio fissis, tubo cuneato profunde immerso inferne varie minute cristato superne nudo, labiis protractis apice integris vel denticulatis, receptaculo incluso vel modo exserto.

LUZON, Bontoc Subprovince, Mount Pukis, *Bur. Sci. 37735 Ramos and Edaño* (type in Phil. Nat. Herb.); Mount Masapilid, *Bur. Sci. 37932 Ramos and Edaño*, altitude 1,500 to 1,800 m (type in Phil. Nat. Herb.).

Probably related to *H. barbatum* more than to any previously known local species.

15. HYMENOPHYLLUM MERRILLII Christ. Plate 13.

Hymenophyllum Merrillii CHRIST, Philip. Journ. Sci. § C 2 (1907) 154.

Leptocionium, ex affinitate *H. holochili* (v. d. B.) C. Chr., Javanici, caespitosum, minus, laciniis brevioribus, colore atrofusco, textura crassiore.

Rhizomate filiformi repente caespitoso, cum stipite rhachique pilis rufis brevibus parce vestito, stipite filiformi 3 cm. longo, fronde ovata acuminata versus basin attenuata 6 cm. longa, 2 cm. lata, bipinnatifida, pinnis confertis ca. 8 utrinque, cuneato-ovatis antice acutis sessilibus nec adnatis infimis petiolulatis 6 mm. latis profunde pinnatifidis, segmentis cuneato-obtusis 3 utrinque, profunde laciniatis, laciniis lanceolatis 2 mm. latis serrulato-dentatis planis, rhachi haud alata, soris infimae laciniae anteriori pinnarum insidentibus, pro pinna solitariis, 3 aut 4 utroque rhachcos latere, ovatis, 2.5 mm. longis, apice bivalvatis serrulatis, receptaculo crasso valde exserto. Colore atrofusco. Textura rigidiuscula.

LUZON, Province of Pampanga, Mount Arayat (1927 *Merrill*) October, 1904; Province of Bataan, Mount Mariveles (*Loher*) March, 1837, alt. 1,400 m.—CHRIST, loc. cit.

As in all relatives, the rachis is winged toward the apex of the frond. The real segments—that is, the ultimate divisions of the frond, containing a single vein—are not more than 1 mm

wide; the dissection is imperfect, so that there are uncut central areas of the pinnæ, 2 mm or more wide, where two or more veins run nearly parallel. The cell walls are irregular and slightly irregularly thickened where they come to the surface, but there is nowhere any appearance of regular teeth. The involucres are cleft more or less halfway down, the base of the tube ornate with a few hairs and stouter hairlike outgrowths consisting of two or three rows of cells, lips broadly rounded, denticulate.

LUZON, Pampanga Province, Mount Arayat, *Loher 849* (ident. by Christ as *H. multifidum*), *Merrill 3927* (cotype in Phil. Nat. Herb.), *Bur. Sci. 22444 Ramos;* Laguna Province, Mount Maquiling, *Bur. Sci. 18731 Ramos.* Endemic in central Luzon.

16. HYMENOPHYLLUM RAMOSII Copeland sp. nov. Plate 9, figs. 4 to 6.

Rhizomate late repente, 0.6 mm crasso, glabrescente; stipite ca. 5 cm alto, 0.6 mm crasso, rigido, nudo, fusco-nigro, sursum angustissime alato; fronde deltoideo-orbiculari, 6 cm longa et lata, basi quadripinnatifida, glabra, fusca, rhachi angustissime alata; pinnis tandem latissimis deinde imbricatis, infimis 3 ad 4 cm longis, 2 ad 3 cm latis, rhachibus aequi-anguste alatis; segmentis 3 ad 5 mm longis, ca. 0.7 mm latis, remote argute serrulatis, nec crispis nec undulatis; cellulis nullibi elongatis, parietibus rectis modo incrassatis minute vittatis, rarius dentibus brevibus latisque ornatis; soris plerisque ad pinnulas II infimas non abbreviatas terminalibus, basi vix immersis, involucro ca 1 mm longo latoque, fere ad basin fisso, nudo, labiis apice rotundatis, aut denticulatis, aut apiculatis, aut integris, receptaculo crasso-clavato, incluso.

MINDANAO, Bukidnon Province, Mount Lipa, altitude 2,000 m. on mossy trunks, *Bur. Sci. 38550 Ramos and Edaño* (type in Phil. Nat. Herb.).

A very distinct species, distributed as *H. serrulatum*, to which (*H. Meyenianum*) it probably has some remote affinity, agreeing in color and serrulation. It is a pleasure to dedicate another species to Maximo Ramos, who lost his life in Mindanao after three decades of zealous collecting.

17. HYMENOPHYLLUM HOLOCHILUM (van den Bosch) Christensen. Plate 14.

Hymenophyllum holochilum (van den Bosch) CHRISTENSEN, Index (1905) 226, 362.

Didymoglossum holochilum VAN DEN BOSCH, Plant. Jungh. 1 (1856) 561.

Leptocionium holochilum VAN DEN BOSCH, Synopsis (1859) 43. Hymen. Javan. (1861) 44, *pl. 34.*

Didymoglossum affine VAN DEN BOSCH, Pl. Jungh. (1856) 552 (not seen).

Leptocionium affine VAN DEN BOSCH, Synopsis 43, Hymen. Javan. 45, *pl. 35*.

Hymenophyllum affine RACIBORSKI, Pterid. Buitenzorg (1898) 20, non Brack. (1854).

Hymenophyllum Boschii ROSENSTOCK, Bull. Jard. Bot. Buitenzorg II No. 11 (1911) 24.

Hymenophyllum hamuliferum v. A. VAN ROSENBURGH, Bull. Jard. Bot. Buitenzorg II No. 28 (1918) 29.

Hymenophyllum Kurzii PRANTL, Hymen. (1875) 54.

Hymenophyllum linggaense v. A. VAN ROSENBURGH, Bull. Jard. Bot. Buitenzorg III 5 (1922) 208.

Fronde suboblongo-lanceolata bipinnatifida, laciniis primariis latiuscule ovatis secundariisque furcatis simplicibusque subcontiguis erecto-patulis; lacinulis latis subelongatis planiusculis denticulatis, denticulis brevibus remotis, e cellulis pellucidis magnis regularibus elongatis acutangulis globuloso-viridibus contexta, rhachi hirsuta inferne subobsolete marginata, soris immersis lanceolatis, tubo conico late marginato glabro, labiis subintegris tubum aequantibus, stipite s. toreto s. obsolete alato subhirsuto fronde usque dimidio breviore.

Hab. ad truncos muscosos Javae; Herb. AL. BRAUN; in m. Salak, *Coll.* I N. 365 *a x* (in Herb. FRANQUEV.), *Coll.* I N. 215, ZOLLINGER.

Rhizoma setaceum horizontale ramosum parce hirsutum; stipes 3 fere centim. longus s. teres, s. angustissime alato-marginatus tenuiter paleacco-hirsutus; frons 4–6 centim. longa, 1½–2 lata tenera membranacea diaphana viridi-olivacea lanceolata vel oblongo-lanceolata bipinnatifida, laciniis primariis erecto-patulis subaequidistantibus contiguis e basi cuneata plus minusve late ovatis, secundariis, inferioribus 1- rarius 2-furcatis, simplicibus furcatisve contiguis vel remotiusculis, lacinulis late linearibus parumper elongatis planiusculis, margine leviter undulatis sinuato-denticulatis, denticulis remotis inaequalibus latis brevibus obtusis, apice rotundatis retusisve; sori maximi in lacinulis primariis axillares, in lacinula valde abbreviata immersi lanceolati, tubo late marginato conico glabro, labiis tubum longitudine aequantibus integris leviterve antice repandis, receptaculo setaceo tandem exserto?; rhachis superne latius, inferne s. anguste s. obsolete marginata venaeque et venulae validiusculae strictae; cellulae tenerae pellucidae magnae subanguloso regulares elongato-hexaëdrae acutangulae, parietibus hyalinis rectis parum incrassatis, interiorem diffusis globulosis, globulis parvis viridibus; marginales minores subconformes pariete exteriore hic illic indistincte et minute crenulato.

—VAN DEN BOSCH, Hymen. Javan.

The essential distinctive features of *Leptocionium affine* were "parietibus diaphanis flexuoso-crenatis incrassatis," and "labiis tubo 3-plo brevioribus rotundato-triangularibus antice acute denticulatis." Both had the base of the tube ornamented by a band of longitudinal ridges or crests, and in most recent literature this has been the most emphasized feature of the species.

A small fern, with filamentous, glabrescent, mostly or wholly terete stipe, and rachis usually terete near the base, and with an entire wing in the upper part of the frond; frond plane or practically so; lacinie serrate but with teeth less developed than those of *H. denticulatum*. Construing the two species of van den Bosch as one, it has a considerable range in specialization of walls, but not as much as his figures of *H. holochilum* would make one expect. A mere glance at his fragments shows that the perfectly smooth and even thin walls shown by figs. 6 to 9 of his plate 34 do not exist. The "parum incrassatis" of his text is more suggestive. They are somewhat nodulose-thickened in median optical section, and are more (but discontinuously) thickened, and more or less wavy, at the surface. In a few places, toothing is evident. I have nowhere detected teeth on the marginal wall. Although feebly developed, this modification of the wall is of the type better developed in the commoner "*L. affine*"—*H. Boschii*. The range in variation of development of thickening and irregularity is just about the same found in *H. Meyenianum*.

Perfectly authentic *H. holochilum*—that is, named by van den Bosch in distinction to his *L. affine*—exists on only two sheets, of which one bears only sterile fragments, and the other (ex Herb. Hasskarl) no well-developed sorus; what I find are *mediocres* at most, not *maximi*. In fact, I find in no herbarium (except for another *Hasskarl* sheet in Herb. Ludg.-Bat.) another specimen perfectly matching these in feeble differentiation of walls and in supposed sorus characters. The sori of what I call *H. holochilum* are in general not large. The involucre is cleft one-third to one-half of the way down or a little farther. The much emphasized ribs on the base of the tube can usually be detected on the dorsal surface only, the side of the frond somewhat hairy when immature. They are homologous with the crests of *H. denticulatum*. On one authentic sheet I find one of them free and bent at the upper end—becoming a tooth. And on two Papuan specimens I find them replaced by hairs, so closely appressed that only very careful study revealed the difference. The lips are more often entire than denticulate; thus they represent typical *H. holochilum*. But almost all specimens have the cell walls of *L. affine*. Rosenstock referred specimens from Borneo and Sumatra with entire lips to *H. Boschii* var. *euryglossa*. The receptacle is normally exserted. A form with acute lips and exserted receptacle was called var. *subgenuinum*

by van Alderwerelt, Bull. Jard. Bot. Buitenzorg II No. 20 (1915) 19.

For fifty years *H. holochilum* was regarded as endemic in Java. More recently it has been reported repeatedly from Borneo, Sumatra, the Peninsula, and Papua. Within the limits of variation of walls and lips already described, it is a well-defined species in Java. *Rünnemeyer 2057* from Banca, the type collection of *H. hamuliferum*, amply represented in Herb. Ludg.-Bat., matches Javan material perfectly. *Bamler (Ros. Fil. novoguin.) 208* from Papua is typical except for the hairs already mentioned. His *208a*, var. *minor* Rosenstock, is sterile in our material, and therefore strikes me as a juvenile form. *Schlechter 16743* has the internal structure of *L. affine*, but the base of the involucre bears again some hairs but no ribs, and the lips are elongate, acute, and deeply toothed. *Drs. v. Leeuwen 9806, 9942*, and *10229*, unlike one another, may all be *H. holochilum*, but are notably hairy, short-stipitate, black, and finely divided.

Of Bornean specimens, *Topping 1707* and *1729*, and *Clemens 51211* and *51397*, all from Kinabalu, have some teeth on the wing of the rachis, the lips entire. *Elmer 21326* has minute sori, without ribs. From Sumatra, *Lörzing 6607* is most nearly typical, but has very small sori and a very narrow wing. *Winkler (Ros., Fil. Sumat.) 208* in Phil. Nat. Herb. has the marginal teeth of *H. denticulatum;* in Herb. Univ. Calif. it is typical except for small sori. *Posthumus 785* is hairy and dark. Other Sumatra specimens, and all I have seen from the Peninsula, belong rather to the group or species of *H. edentulum*.

A cotype of *H. linggaanum* is in the Herb. Ludg.-Bat. It is described by van Alderwerelt, but I find no satisfactory distinction from *H. holochilum*—as *H. Boschii*—unless it be that the serrulation is less evident. The structure and the sori match that form very well. The internal walls are toothed at the surface, but less thickened as a whole than those characteristic of the *edentulum* group.

Specimens: JAVA, *Hasskarl, Raciborski, Fleischer 21, Palmer and Bryant 316, 481, 518, Bakh van den Brink 1490B, 5878, 7088, v. Steenis 2791.*

Hymenophyllum holochilum is probably more nearly related to *H. denticulatum* than to any other of the better-known species with more ample fronds. It is still more nearly related to a plastic group of inconspicuous small ferns, with well toward as

many specific names as named specimens, characterized by size, form, and structure, but unstable in margin and fructification, sharing the characters of *Trichomanes* and *Hymenophyllum*, and not really at home in either genus. The group ranges from the Mascarenes (*H. ricciaefolium*) to Assam (?), Luzon, and Papua. In its absence of constant specific characters, the group is altogether like *Taschneria* in *Trichomanes*.

Hymenophyllum holochilum is probably the only Javan representative of this group. *Hymenophyllum Kurzii* Prantl has never been described so that it might be recognized with any confidence. It seems to have been meant to be distinguished by apical sori; and as this feature is not diagnostic, I presume that it is a chance or edaphic form of *H. holochilum*. Specimens are in the Munich Herbarium.

17a. HYMENOPHYLLUM RUFIFOLIUM v. A. van Rosenburgh.

Hymenophyllum rufifolium v. A. VAN ROSENBURGH, Bull. Jard. Bot. Buitenzorg II No. 28 (1918) 28.

From Sumatra, typified by *Bünnemeyer 925*, not seen. The author does not compare this with any other species, but the description suggests resemblance to *H. holochilum*. Frond 3 to 5 cm long; rachis winged in the upper part only, segments apparently few, 0.5 to 1 mm wide, remotely serrate with long teeth; involucre narrowly obovate, lips fimbriate-dentate.

17b. HYMENOPHYLLUM RUFIFRONS v. A. van Rosenburgh.

Hymenophyllum rufifrons v. A. VAN ROSENBURGH, Bull. Jard. Bot. Buitenzorg II No. 28 (1918) 28.

This is from Sumatra, described as very near "*H. serrulatum*," and based on *Brooks 295 / S*, which I have not seen. The base of the involucre is described as "extus minutissime glandulosa;" and the valves as "apice obtuso gracillime eroso-serrulatis," which distinguish it very sufficiently from *H. Meyenianum* and *H. Bakeri*. It is larger than *H. holochilum*—up to 15 cm in length of frond.

Apparently related to *H. holochilum* are the following six described species from New Guinea of which I have seen no authentic specimen:

17c. HYMENOPHYLLUM ELBERTI Rosenstock.

H. Elberti ROSENSTOCK, Meded. Rijks Herb. Leyden No. 14 (1912) 31.

Stipe 2.5 to 3 cm long; lamina 5 to 6 by 1.5 to 2.5 cm, brown, naked except for costæ and veins; pinnæ deeply pinnatifid; segments linear, the basal ones forked, acutely dentate; rachis

narrowly winged, sparsely hairy with "flavidis" hairs; sori near apex, involucre cut halfway down, lips subtriangular, obtuse, entire, receptacle long-exserted. *Grundler 2312*. Nothing in the description distinguishes it from *H. holochilum*.

174. HYMENOPHYLLUM BREVIDENS v. A. van Rosenburgh.

H. brevidens v. A. VAN ROSENBURGH, Bull. Jard. Bot. Buitenzorg II No. 7 (1912) 20.

Leptocionium.—H. holochilo C. Chr. (forma typica) affine sed stipites longiores, crassiores, decidue longe ferrugineo-pilosi; frondes majores, ovatae, ca 12 cm longae, ca 9 cm latae, 4–5-pinnatae, rachidibus omnibus alatis et subtus decidue longe ferrugineo-pilosis, segmentis ultimis numerosis, ca ½ mm latis, margine non vel vix crispatis, remote brevi-serrulatis; sori in pinnulis subaxillares, indusio oblongo, 2-marginato, basi longitudinaliter cristato, lobis subtriangularibus, integerrimis vel obsolete repandis.

New Guinea (Johannes-Keyts Mountains, le Cocq d'Armandville No. 238).—V. A. VAN ROSENBURGH, loc. cit.

175. HYMENOPHYLLUM TORRICELLIANUM v. A. van Rosenburgh.

H. torricellianum V. A. VAN ROSENBURGH, Bull. Jard. Bot. Buitenzorg II No. 11 (1913) 14.

Like *H. brevidens* in size and dissection. The differences are that it has longer, and acutely serrate segments; it is said also to be less freely soriferous and to have an extruded receptacle, but one need not doubt that that of *H. brevidens* is normally extruded. The type is *Schlechter 14543*.

176. HYMENOPHYLLUM ELLIPTICOSORUM v. A. van Rosenburgh.

H. ellipticosorum V. A. VAN ROSENBURGH, Nova Guinea 14 (1924) 27.

Stipe 2 to 3 cm long, narrowly winged; fronds 3 to 6 cm long, 1.5 to 2.5 cm wide, "glabrae" (but "stipitibus, rachidibus, costis, costulis venisque pilosis"), subtripinnatifid; segments 7.5 to 10 mm long, 1.5 to 2 mm wide, serrate with oblique, longish, short-subulate teeth; sori "majusculi," involucre two-thirds cleft, base of tube hairy on the back, valves irregularly subdenticulate. Type: *Lam 1469*, Indenburg River, altitude 1,420 m.

177. HYMENOPHYLLUM NUTANTIFOLIUM v. A. van Rosenburgh.

H. nutantifolium V. A. VAN ROSENBURGH, Nova Guinea 14 (1924) 27.

Stipe 4 to 6 cm long, black, naked or becoming so, sparsely rough; fronds 7.5 to 10 cm long, 6 to 7 cm broad, triangular or ovate, subquadripinnatifid, rachis winged, glabrous or glabrescent, wing entire; segments up to 5 mm long, 0.75 to 1 mm wide, short-serrulate or in places subentire; "indusium majus-

culum," one-third cleft, the back of the tube with 0 to 4 crests which may in part be dentiform, valves denticulate. Type *Lam 1470*, Doorman Summit, altitude 1,420 m.

Antedating the preceding five names, perhaps identical with one of them, but without a description sufficient to warrant an opinion.

17b. HYMENOPHYLLUM PEDICULARIFOLIUM Cesati.

Hymenophyllum pedicularifolium CESATI, Rend. Accad. Sci. Napoli 16 (1877) 24, 28; BAKER, Ann. of Bot. 5 (1891) 193.

Sphærocionium, *H. asplenioidi* proximum, a quo differt: fronde subsessili, undulata s. crispula, supra glabra, subtus costulis rufo-pilosis; involucris magis elongatis.—CESATI, op. cit. 28.

Terra dei Papuas: m. Arfak ad Hatam (5–7000'); Juglio 1875. —CESATI, op. cit. 24.

17c. HYMENOPHYLLUM CINCINNATUM Copp.

Hymenophyllum cincinnatum GEPP, in Gibbs, Dutch N. W. New Guinea (1917) 68.

I have not seen this and place it with the preceding species of doubtful position because its author compares it with *H. holochilum*. The stipe, as well as the rachis, is winged throughout.

18. HYMENOPHYLLUM BRACHYGLOSSUM Al. Braun.

Hymenophyllum brachyglossum AL. BRAUN, in Kunze, Bot. Zeit. 5 (1847) 227.

Didymoglossum Brauniі VAN DEN BOSCH, Pl. Jungh. 1 (1856) 560.

Leptocionium Brauniі VAN DEN BOSCH, Synopsis 43; Hymen. Javan. 43, *pl. 35*.

Es unterscheidet sich durch kürzere Lippen der Hülle, lichtbraune Färbung und grössere Durchsichtigkeit des stumpferen und meist auch breiteren Laubes mit stärken Rande.—KUNZE, loc. cit.

The Herbarium Lugduno-Batavum contains ten sheets, mostly sterile, of this species, of which the most recent, so far as they are dated, was collected in 1861; most of them were identified by van den Bosch and they do not necessarily represent nearly ten distinct collections. The Gray Herbarium contains one (sterile) specimen, mounted as *H. denticulatum*, with hardly legible data, apparently collected on Mount Gedeh in 1846, perhaps a cotype; unlike the Leyden specimens, it has the rachis winged throughout, being perhaps juvenile.

This is smaller than *H. denticulatum*, the frond 3 to 5 cm long, 1.5 to 4 cm wide, bipinnatifid with the secondary divisions sometimes forked, not at all crisped; rhizome and stipe finely filamentous; rachis wingless in the lower part in all complete Leyden specimens, and the wing toothless where present

(as Blume in error described that of *H. denticulatum*); segments brown and without blackish margin or teeth, teeth long, mostly of two rows of cells; marginal walls mostly toothed on the inside ("fimbriato-crenulatis," van den Bosch), but in some places smooth and even; internal walls most variable in thickening, even on single fronds, in some places thin, and only slightly crenulate at the surface, in others closely beset with short, thick teeth; involucre cleft one-third to halfway down, with dorsal longitudinal ribs at the base but without free teeth, the lips rounded to subtruncate, fimbriate; receptacle extruded.

As most specimens seen are without fruit, I cannot appraise the diagnostic value of the ribs, instead of teeth, on the tube of the involucre. The partly terete rachis, absence of teeth on the wing where one is present, absence of blackening of margin and teeth, and fimbriate lips look like specific characters. But a Javan "species," supposed to be on the Gedeh, uncollected for over seventy years, must be either very rare or else merely a variant.

All specimens seen are from Java. It has been reported from Borneo; but the Kinabalu specimen, *Topping 1721*, to which I once applied this name is *H. denticulatum*.

This has been sufficiently illustrated, as *Leptocionium Braunii*, by van den Bosch, Hymenophyllaceæ Javanicae, pl. 33.

19. HYMENOPHYLLUM DENTICULATUM Swartz. Plate 15.

Hymenophyllum denticulatum SWARTZ, Schrad. Journ. 1800' (1801) 100 (not seen); Synopsis (1806) 148, 375.

Trichomanes denticulatum POIRET, Lam. Enc. 8 (1808) 75; BLUME, Enum. 226.

Didymoglossum denticulatum HASSKARL, Obs. Bot. 2 (1857) 16.

Leptocionium denticulatum VAN DEN BOSCH, Synopsis (1859) 42; Hymen. Javan. 39, *pl. 29*.

Hymenophyllum dichotomum CAVANILLES, Descr. (1802) 276?; NEES and BLUME, Nova Acta 11 (1823) 127, *pl. 15, fig. 4*; BLUME, Enum. 222.

Hymenophyllum humile NEES and BLUME, Nova Acta 11 (1823) 125, *pl. 13, fig. 3*.

Trichomanes Neesii BLUME, Enum. (1828) 226.

Didymoglossum Neesii PRESL, Hymen. (1843) 115.

Hymenophyllum Neesii HOOKER, Sp. Fil. 1 (1843) 99.

Leptocionium Neesii VAN DEN BOSCH, Synopsis 43, Hymen. Javan. 40, *pl. 30*.

Trichomanes aculeatum J. SMITH, Journ. of Bot. 3 (1841) 417, *nomen, non* Swartz (1788).

Didymoglossum aculeatum VAN DEN BOSCH, Pl. Jungh. (1856) 559.

Leptocionium aculeatum VAN DEN BOSCH, Synopsis 43, Hymen. Javan. 41, *pl. 31*.

Hymenophyllum aculeatum RACIBORSKI, Pterid. Buit. (1898) 21.
Didymoglossum ferox HASSKARL, Fil. Jav. 2 (1857-8) 17.
Hymenophyllum subrotundum v. A. VAN ROSENBERGH, Bull. Jard. Bot. Buitenzorg II No. 20 (1915) 10.

Frond. 3-pinnatifidis ovatis, pinnis dichotomis pinnulisque decurrentibus, laciniis linearibus obtusiusculis sinuato-denticulatis; soris supraaxillaribus. Java.—SWARTZ, Synopsis 148.

Habitat in Java. Thunberg.

Filix subspithamea.

Stipites e surculo repente, subcapillares, teretes, laxi glabri.

Frondes ovatae l. oblongae acutiusculae l. obtusae, 3-pinnatifidae, glabrae, fusco-virides, siccae fusco-brunneae.

Rachis flexuosa, submarginata, praecipue versus apicem frondis.

Pinnae alternae, ovatae dichotome subdivisae, patentes, pollicares, decurrentes, ut et

Pinnulae pariter alternae, divisae in lacinias lineares obtusas l. emarginatas, margine sinuato repando-denticulatas.

Denticuli nudo oculo subsetacei acuti, molliusculi nec rigidi.

Fructificationes supra axillas pinnarum terminalium solitariae, oblongae, erectae.

Indusia erecta, valvulis in cylindrum conniventibus.

H. dichotomum, Cav. prael. 1800, n. 603. huic simile, sed differt; pinnulis distinctioribus laciniis angustioribus margine magis flexuoso undulato, denticulis subspinulosis remotioribus, fructificationibus majoribus.

—SWARTZ, Synopsis 375.

Rhizome and stipe wiry, hairy to glabrescent; a common size of well-developed frond is 7 cm long, 4 cm wide, on a stipe 2.5 cm long, the range upward being to about 10 cm long, lanceolate to ovate, usually with a broad base, the commonest degree of dissection being bipinnatifid with the larger pinnules forked; rachis usually winged throughout and the wing sometimes running to the base of the stipe, everywhere sharply toothed; frond plane, undulate, or slightly to very much crisped. An irregular marginal band, including the teeth, is almost always dark or even black.

There is great irregularity in the thickening of the walls, which is of the same type as in *H. Meyenianum* and *H. holochilum*, but in general less pronounced than in *H. serrulatum* and *H. edentulum*. In median focal plane, the internal walls are usually thin and more or less straight; less commonly, they appear nodulose-thickened, indicating that these walls are broadly, not deeply, pitted. Where they meet the superficial walls, the internal walls may remain thin, but there they are usually finely wavy, and very generally they are more or less thickened, with more or less development of short, stout teeth. This is practically never uniform in all mature parts of a single frond, and

the prevailing degree of thickening varies of course from specimen to specimen. There seems to be some correlation between thickening and crispiness, but I detect none between thickening and size or number of marginal teeth.

The involucres are cleft more or less halfway down. I find no correlation between depth of cutting and any other character. The tube is always beset with teeth or spinelike outgrowths; this development varies from feeble to fairly bizarre; it is imperfectly correlated with crispiness of frond. A few teeth can rarely be detected on the backs of the lips. The margin of the lips is always toothed at the ends, sometimes on the sides. Development in this respect varies from no more than three small teeth at the tip to a beautiful, even fringe of long ones. It is not correlated with crispiness.

I combine here three "species" which it has become customary to regard as distinct, *H. denticulatum*, *H. Neesii*, and *H. aculeatum*. *Hymenophyllum Neesii* was described by Blume (as *Trichomanes*), Enum. 226, immediately preceding his *T. denticulatum*. The descriptions are mostly literally parallel, and the only clear-cut difference is that the rachis of the former is described as undulate-spinulose, of the latter as "superne alata integerrima," which is not true of his own specimens in Herbarium Lugduno-Batavum, or of any specimen which I recognize as this species. The wing is toothed throughout, and it is only on a very few exceptionally lax specimens that I fail to find it and its teeth down to the base of the frond.

Not knowing *H. denticulatum* (Sp. Fil. 101), Hooker (Sp. Fil. 99) combined with *H. Neesii* (which he may have known only by the figure of Nees and Blume) the Philippine plant, *Cuming 146*, which J. Smith had called *Trichomanes aculeatum*. In this, his only follower seems to have been his disciple, Baker, Syn. Fil. 71. *Trichomanes aculeatum* was a synonym, not subject to transfer. *Hymenophyllum aculeatum* is thus invalidated as a name. But in this case I agree with Hooker, that *Cuming 146* is *H. Neesii;* and thus it is *H. denticulatum*. Other distinctions were introduced by van den Bosch. Thus *H. Neesii* was distinguished from the other two by having teeth on the back of the valves, as well as on the base of the involucre; I cannot see them on all specimens he called *H. Neesii*.

I believe that the general opinion has been that *H. denticulatum* was less crisped and less showily toothed than *H. Neesii*, while *H. aculeatum* should be the most crisped and toothed of the three. This may serve to distinguish them as typical forms;

but in every respect they intergrade, and there is no constant parallelism between the several criteria which have been held up as specifically distinctive. All forms are present in Java and in the Philippines; they intergrade in both lands; and it is my impression that the several forms are more directly related to the others in either one land than to the similar forms in the other. Therefore, I am constrained to regard them as a single species. It is not equally clear that I ought not to include also *H. acantholides*.

I accept without question the statement of Christensen, Index Suppl. 3: 114, that *H. dichotomum* came from the Philippines, not, as published, from Chile. It is probably *H. Neesii*. I have already copied the comment of Swartz, who remains still the best authority on many of Cavanilles's plants. As a name, *H. dichotomum* has priority over *H. Neesii* but not over *H. denticulatum*.

Hymenophyllum ferox Hasskarl is described as quite typical *L. Neesii*, and was found on Mount Gedeh where *H. denticulatum* in various forms is common. I find no specimen bearing the name *ferox*, but the Herb. Lugd.-Bat. contains perfect evidence that Hasskarl did not know *H. denticulatum*, in the form of two sheets of it collected later (1858), one labeled by him *Hymenophyllum?*, and the other *Trichomanes?*.

Hymenophyllum subrotundum was described as "Hymenophyllo affini Rac. (non Brack.) affine." I have not seen the original collection; but *Posthumus 1082 bis*, so determined by the collector, in Herb. Lugd.-Bat., fits the description and in my opinion consists of young (not stunted) plants of *H. denticulatum*.

Range: Java to Ceylon, Assam, Luzon, and Fiji.

Specimens: JAVA, *Thunberg*, fragment in Herb. Lugd.-Bat., *Blume*, in same herbarium as *T. denticulatum* and *T. Neesii*, *Reinwardt*, *Korthals*, *Zollinger*, *Hasskarl*, *Junghuhn*, *Boerlage*, *Raciborski*, *Mousset* (*Ros. Fil. Jav. Or. 56*), *Bakh van den Brink 2386, 2394, 2606, 3396, 3369, 6150, 6500, 6963, 6964, 7040*, *Gerkens*, *Winckel 1209B, 1489B*, *Palmer and Bryant 359, 409, 464, 577, 588, 600*, *Buysman Herb. Anal. 46, 198*, *v. Leeuwen 10966*. SUMATRA, Herb. Weiss in Herb. Lugd.-Bat., *Bartlett 7979, 8477, 8482*, *Winkler*, *Yates 2486*. BORNEO, *Topping 1721, 1851*, *Elmer 20681*, *Clemens 11042, 50891, 51113*, *Winkler 2353, 3023*. MALAY PENINSULA, *Maingay 1739*, *Scortechini 502*, *Henderson Sing. No. 21671, 22092*, *Burkill and Holttum 8415*, *Holttum 9558, 16713, 20596*, *Nur 17400*. CEYLON, *Wall 1004*, *Beckett 202*,

Thwaites C. P. 2934. ASSAM. *Mann.* HAINAN, *Fryl Smith 1404.* INDO-CHINA, *Pételot 3328.* PHILIPPINES, *Cuming 146, Brackenridge, Loher 1196, Whitford 442, 795, 971, Merrill 3231, 6058, 6071, Williams 462, Copeland 209, Topping 819, Elmer 7034, 7976, Bolster 268, F. B. 16910, 19132, Bur. Sci. 9461, 18438, 13506, 19385, 23445, 29263, 29746, 30771, 30841, 31314, 33265, 40616, 41584, 41904, 48564, 77982, 79633, 80144.* FORMOSA, *Sasaki.* BALI, *Sarip* (Exp. Maier) *327, 404, 484.* NEW GUINEA, *Bamler* (*Ros. Fil. merog.*) *193, v. Leeuwen 9193* (with opaque cell contents). FIJI, *Parks 20007, 20191, 20204.*

10. HYMENOPHYLLUM HOSEI Copeland. Plate 16.

Hymenophyllum Hosei COPELAND, Philip. Journ. Sci. § C 12 (1917) 46; CHRISTENSEN, Mitt. Inst. Bot. Hamburg 7 (1928) 143.

Leptocionium lamina plana, rhachi late alata; rhizomate crasso-filiforme, glabrescente, laete fusco; stipite 10 ad 17 mm alto, fere ad basin alato; fronde 4 ad 5 cm alta, 2 ad 3 cm lata, ovata, bi-tri-pinnatifida, rhachi nigro-fusca, ubique late alata ala denticulis sparsis ornata; pinnis inframedialibus majoribus, ad alam rhachidium iparum pinnatifidis, pinnulis superioribus simplicibus, inferioribus furcatis vel rarius pinnatifidis cum 3 ad 5 segmentis; segmentis 2 ad 3 mm longis, 0.8 mm latis, obtusis, ubique anguste denticulatis, marginibus et dentibus nigrescentibus, lamina alibi fuscescente; soris in segmenta prima acroscopica pinnarum superiorium insertis, parte inferiore obconica immersa, receptaculo crasso-setiforme, labiis fere aequilongo, involucro extus deorsum denticulato vel aspero vel fere nudo, ca. ad medium fisso, labiis ovatis inconspicue dentatis.

Sarawak, Mount Trekan, altitude 600 meters, *Hose 730*, 1894–95.

Distinguished from otherwise similar species by the broad, flat wing of the rachis. The blackish margin is occasionally found in other species and may not be a constant character.—COPELAND, loc. cit.

I have seen the type collection only. Christensen cites two collections by Winkler from West Borneo.

A derivative of *H. denticulatum*, distinguished by the flat wing and nearly smooth involucre; perhaps better reduced to the parent species. It is usual for *H. denticulatum* in Borneo to be less crisped than is usual elsewhere. *Elmer 20681*, from Tawao, British North Borneo, is in fact plane with the closely placed teeth standing uniformly in the same plane, but the back of the involucre is quite ornate.

Narrow fronds are superficially like *H. edentulum*, but the toothed wing shows that it is not one of that group.

11. HYMENOPHYLLUM ACANTHOIDES (van den Bosch) Rosenstock. Plate 17.

Hymenophyllum acanthoides (van den Bosch) ROSENSTOCK, Bull. Jard. Bot. Buitenzorg II No. 2 (1911) 25; CHRISTENSEN, Mitt. Inst. Bot. Hamburg 7 (1928) 144.

Didymoglossum acanthoides VAN DEN BOSCH, Plant. Jungh. 1 (1850) 16.

Leptocionium acanthoides VAN DEN BOSCH, Synopsis (1859) 43, Hymen. Javan. (1861) 42, *pl. 32*.

Hymenophyllum subinifolium BAKER, Syn. Fil. (1867) 71.

Hymenophyllum aculeatum et *H. Necsii* auct., in error.

Fronde a cuneato subovata bipinnatifida, lacinis primariis lanceolatis contiguis patulis, secundariis remotis erectis, lacinulis latiusculis elongatis undulatis crispato-sequorrosis lacero-dentatis, e cellulis maximis regularibus valde elongatis subacutangulis flexuoso-crenulatis fusciduli contexta, rhachi deorsum anguste alata, soris maximis semiimmersis ovatis, tubo rotundato conico dorso, pariter ac labia tubo aequilonga lacero-dentata, dorso aculeato, stipite apice alato frondem lanceolatine aequante.

—VAN DEN BOSCH, Hymen. Javan.

Hab. ad truncos muscosos Javae; in m. Gedé, v. GESKER; ibidem et in m. Salak, *Coll.* I. N. 662 (in Herb. Franquev.), N. 503 *ex* (in Herb. SONDER) et *Coll.* II N. 72, ZOLLINGER.

—VAN DEN BOSCH, Hymen. Javan. 42.

Rhizome and stipe densely hairy, tardily glabrescent, stipe 1 to 4 cm long, frond up to 5 cm (commonly, about 3 cm) long, deltoid to ovate, tripinnatifid with forked secondary pinnules; rachis winged throughout or nearly so, and the wing sometimes reaching the base of the stipe, crisped and toothed; all divisions of the frond about equally winged, moderately to exceedingly crisped, and bearing very long and irregular teeth; internal walls nodulose-thickened in optical section, more thickened and wavy or short-toothed where they reach the surface; sori large, sessile, winged at the base, involucre cleft more or less halfway down, densely and irregularly toothed along the margin and on the tube, and with some teeth even on the back of the lips, involucre extruded.

This is intimately related to *H. denticulatum*. The *v. Gesker* collection, probably to be regarded as the type, is its least differentiated form, with suberect pinnules, segments fully 2 mm wide including the teeth, and an uncut axial wing 1 mm wide which is only moderately crisped. A *Junghuhn* collection mounted on the same sheet (*Herb. Lugd.-Bat. No. 903, 279–482*), more spreading and more toothed, better exemplifies the species. *Zollinger 890*, probably the type collection of *H. subinifolium*, is more spreading, with narrower lamina and more contorted and toothed. I illustrate the species by a specimen from Sumatra ex Herb. Waitz, mixed with *H. paranicum*, *Herb. Lugd.-Bat. 903, 279–718*, a rather extreme form.

Specimens: JAVA, *Junghuhn, v. Gesker, Zollinger 590, Bakh van den Brink 2614, Kurz 291, Giesenhagen 88, Raciborski.* SUMATRA; (subject of Plate 17, collector unknown), *Lantemann, Winkler-Kos. Fil. Sumat. 206.* PENINSULA, *King's collector 1548, Henderson 17734, 18018, Nur 11739.* BORNEO, *Bur. Sci. 931 native collector.* PHILIPPINES, *Merrill 6059, Elmer 9825, 11799a, Weber s. n., Loher 13490, Bur. Sci. 9377, 10007, 12079, 16662, 17524, 19395, 19642, 20419, 28603, 28650, 29746, 30341, 31314, 33333, 33888, 37746, 38029, 38086, 39085, 41013, 41943, 44795, 78696, 78701, 78702, 79793.*

It is reported by Nakai, Bot. Mag. 40 (1926) 242, from Formosa, which is likely to be correct, as it is common at the north end of Luzon; but the characters by which Nakai identified it are a half-winged stipe and included receptacle, neither of which will serve the purpose. Also, Brause, Bot. Jahrb. 56 (1920) 45, reports it in two varietal forms from New Guinea; I have not seen them.

22. HYMENOPHYLLUM CARUNCULUS Christensen.

Hymenophyllum caruncultus CHRISTENSEN, Mitt. Inst. Bot. Hamburg 7 (1928) 144.

Leptocionium rhizomate filiformi repente, pilis claro-brunneis sat dense vestito. Foliis remotis, stipitibus ad 3.5 cm longis, pilis mollibus claro-brunneis pubescentibus, versus apicem anguste alatis. Lamina deltoidea s. ovata s. oblonga s. oblanceolata, 3–5 cm longa, 2–3 cm lata, in siccitate brunnea, tripinnatisecta, infra ad rachin costasque rufo-pilosis. Rhachi costis venisque II et III ordinis aequaliter alatis; ala parenchymatica vix ultra 0.5 mm lata crispato-undulata nec plicata laceratim lobata, lobis e basi triangulari subito in 1–3 dentes subulatas crispatas contractis; segmentis ultimis remotis saepe divaricatis. Soris in apicibus segmenti basali acroscopici, ad medium valvatis, dorso e basi ad medium vel ultra dense spinosis, marginibus exterioribus acute dentatis, receptaculo breve exserto.

West-Borneo: Auf dem Bukit Mchipit, um 500 m, Urwald. (Hans Winkler n. 745, 10. Dezember 1924.)—CHRISTENSEN, loc. cit.

Christensen and Holttum, Gardens' Bull. 7 (1934) 215, report it from Mount Kinabalu, *Gibbs 4020, Holttum 25251, Clemens 29027.*

By Doctor Christensen's courtesy, I have a type fragment and *Holttum 25251.* I have only to copy his comment in the Gardens' Bulletin: "This species is very near *Leptocionium acanthoides* v. d. B. . . ., differing in the rather densely reddish pilose stipe and rachis." It does not require separate illustration,

which would only show the much more abundant hairs, but not their reddish color.

33. HYMENOPHYLLUM KERIANUM Watts.

Hymenophyllum kerianum WATTS, Proc. Linn. Soc. New South Wales 39 (1915) 767, pl. 57, fig. 6, not seen.

I have from Mr. C. T. White a part of the type collection from Frenchman's Creek, base of Bellenden Ker, on rocks, *W. W. Watts*, and a recent collection, *Brass 2172*, from Mossman River Gorge, both in North Queensland. It is a dwarf derivative or form of *H. denticulatum*, and could be regarded as that species if found in Java. As long as the normal *H. denticulatum* is unknown in Australia, *H. kerianum* may better be regarded as a derived species.

The stipe is about 1.5 cm long, mostly winged; frond 2.5 cm long, 1.5 to 2 cm broad; involucre moderately crested on the base of the tube; lips very prettily laceraie-dentate. The wing of the rachis is moderately crisped, and the margin everywhere rather sparsely toothed.

34. HYMENOPHYLLUM MACROSORUM v. A. van Rosenburgh.

Hymenophyllum macrosorum V. A. VAN ROSENBURGH, Bull. Jard. Bot. Buitenzorg II No. 16 (1914) 18.

Leptocionium.—Rhizoma longe repenes, filiforme, pilis longis, deciduis, ferrugineis ornatum. Stipites sparsi, filiformes, ca 1–4 cm longi, deciduo pilosi, sursum alati. Frondes firmiter membranaceae, glabrae, lanceolato-oblongae, ca 2–8 cm longae, 1–2½ cm latae, 3–4-pinnatae, rachidibus alatis. Pinnae erecto-patentes, contiguae, sat undulatae, usque ad 2 cm longae et 1 cm latae. Segmenta ultima linearia, ca ¾–1 mm lata, marginibus (cum marginibus alarum) undulatae (crispatae) et dentatae, dentibus brevibus vel longi-subulatis; venulae in segmentis ultimis solitariae centralesque. Sori magni, ca 3–4 mm longi, axillares, in speciminibus minoribus ad pinnulas infimas anticas positi, in speciminibus majoribus magis copiosi; indusium profunde 2-valvum, basi obconicum, appendiculbus longi-fimbriatis ornatum, valvis semiorbicularibus integerrimisque; receptaculum exsertum.

Sumatra (*Mt. Singgalang*, C. G. Matthew No. 705).

Known by the type collection, of which a frond is in the Herbarium Lugduno-Batavum. This has a filiform stipe 2.5 cm long, the frond 7 cm long, 2 cm wide, brown; the rachis and segments are rolled in rather than crisped; undivided segments up to 5 mm long; marginal teeth many, sometimes remarkably attenuate; cell walls very thin, straight, not modified at the surface.

The toothed wing of the rachis and the ornate tube of the involucre suggest affinity to *H. denticulatum*, but in other re-

spects—color, general aspect, cell walls, lips of involucre—it is very distinct.

From the same locality, Mount Singgalang, comes *Yates 2440*, in Herb. Univ. Calif., with identical huge sori, but absolutely without marginal teeth. Except for the sori, it is *H. polyanthos*.

13. HYMENOPHYLLUM LOBBII Moore.

Hymenophyllum Lobbii MOORE, in van den Bosch, Ned. Kruid. Arch. 53 (1863) 176; CHRISTENSEN, Gardens' Bull. S. S. 7 (1934) 214.
Trichomanes serratulum BAKER, Syn. Fil. (1867) 80.
Hymenophyllum subflabellatum CESATI, Atti Accad. Napoli 8 (1876) 8.

H. Lobbii MOORE in Hb. HOOK. Fronde lineari pinnata (pinnis anguste decurrentibus), pinnis patulis apice leviter incurvis contiguis obcuneatis sive 1–2 furcatis (quasi 2–3 fidis), sive pinnatifidis (utrinque lacinula unica), lacinulis subfastigiatis (quasi secundis) anguste linearibus planis margine serratis, dentibus remotis e basi angusta subulatis elongatis, cellulis firmis opacis regularibus hexaëdris acutangulis leviter elongatis, parietibus tenuibus sordide hyalinis rectis vel levissime dentato-flexuosis, interaneis diffusis spissiusculis grumulosis e viridi olivascentibus, marginalium pariete exteriore crenulato, rhachi filiformi flexuosa (excepto apice) pinnis decurrentibus angustissime alata, soris in fronde apicalibus exsertis parvis, indusio tubuloso aequaliter dilatato compresso basin usque bilobo, lobis antice truncato-rotundatis inaequaliter subulato-dentatis, receptaculo setaceo crasso indusio usque 2 longiore, stipite filiformi tereti flexuoso 10–15 millim. longo. Rhizoma filiforme ramosum pilis fulvis facile detersis hirsutum, frons 3–4 centim. longa, 6–8 millim. lata membranacea subopaca firmiuscula rubro-fusca.

Hab. Ins. Malasicae, TH. LOBB? India orientalis (Assam), GRIFFITH (Hb. Hook.).—VAN DEN BOSCH, loc. cit.

T. serratulum. Baker, *rhizome* slender, wide-creeping; *st.* slender, naked, about ½ in. l.; *fr.* under 1 in. l., about ½ in. br., oblong, or subrhomboidal in general outline, pinnatifid down to a narrowly-winged rachis; *segm.* erecto-patent, in 2–6 pairs, linear, simple or forked, ½ in. l., under ⅛ in. br., toothed at the margin, texture membranaceous; a central *costa* only in each segment; spurious *venules* none; *sori* 1 to 2, terminal on the upper segments, the tube exserted or even stipitate, the mouth slightly two-lipped, deeply ciliated with sharp linear teeth.—BAKER, loc. cit.

The name ascribed to Moore is retained for this species with a grain of salt; perhaps a whole dose would be better. I have no reason to doubt the correctness of Christensen's statement that the same *Lobb* collection which provides the name served also as the type of *T. serratulum* Baker, and that Cesati's species is identical. But I have hardly more doubt that van den Bosch's description was based on the Assam plant, nor that the two plants cited by him are distinct. His herbarium contains neither fragment nor sketches of Lobb's plant. It does contain frag-

ments and sketches of Griffith's Assam plant, and the description is based wholly on this collection. It is probably the Himalayan plant which I construe as *H. barbatum* (*H. khasianum* Baker). I am as sure as one can be without seeing the Lobb collection that it is distinct; as one item, note Baker's description of the involucre of *T. serratulum* with "the mouth slightly two-lipped," and van den Bosch's "basin usque bilobo." The name "Lobbii" must, practically, belong to a Lobb collection, one being cited, even with doubt; and the type is explicitly in the Hooker Herbarium. But the publication under this name of the description of a different plant is dubious validation of Moore's *nomen nudum*.

A minute fern, with finely wiry stipe 6 to 8 mm long; frond flabellate-pinnatifid and up to 1 cm long and wide, or, when better developed, pinnate and up to 18 mm long, the rachis terete at the base, narrowly winged upward, pinnæ mostly forked, or the basal ones with two acropetal segments, segments 2 to 3 mm long, 0.7 mm wide, sharply serrate; cell walls thin and in general straight, marginal ones short-toothed on the inside, internal ones mostly wavy and irregularly somewhat thickened at the surface, but rarely at all toothed; sorus usually single and terminal, involucre about 1 mm long, wingless, naked, cleft hardly halfway down, lips rounded, aculeate-dentate at the ends.

Endemic in Borneo.

Specimens: BORNEO, Sarawak, *Beccari* (type of *H. subflabellatum*), *Bur. Sci. 1542 native collector*, *Clemens 20408*; Mount Kinabalu, *Clemens 28006*; Southeast (Dutch) Borneo, *Winkler 2459*.

I do not recognize the affinity of this dwarf to any better-developed species.

28. HYMENOPHYLLUM BLANDUM Racib. Plate 18.

Hymenophyllum blandum RACIBORSKI, Pterid. Buitenz. (1898) 20.

Rhizom fadenförmig, bis 0.2 m.m. dick, spärlich behaart. Blattstiele 1.5-2.5 c.m. lang, fadenförmig, sehr dünn. Lamina unregelmässig eiförmig, bis 1.5 c.m. breit, bis 2 c.m. lang, einfach gefiedert. Die unteren Blättchen gewöhnlich gegabelt, oder in drei Lacinien getheilt, sehr kurz gestielt, mit linearen 2 m.m. breiten, am Rande gezähnten Lacinien, die mittleren Blättchen mit verschmälerter Basis sitzend, ungetheilt. Zusammen sind 1, 2 bis 4 Blättchen an jeder Seite der dünnen, ungeflügelten Rhachis. Sori bis 1.5 m.m. lang, 1 m.m. breit; Indusialklappen gegen die Basis verschmälert, am Scheitel hoch abgerundet und gezähnt.

Epiphyt an Baumstämmen der mittleren Waldzone am Salak. Sehr dicke und ausgebreitete Polster bildend, die unteren Blätter sterben ab, an

der Oberfläche der Polster vegetiren neue. Verwandt mit H. Wilsoni. Ob es nicht vielleicht durch irgend welche Bedingungsgängen in der Entwickelung gehemmte Exemplare von H. affine Bosch sind, vermag ich nicht zu entscheiden.—RACIBORSKI, loc. cit.

The type being presumably in Buitenzorg, there are cotypes in Herb. Lugd.-Bat. and Phil. Nat. Herb. There are two subsequent collections from the same place by Bakh van den Brink, one of them, *5880*, mixed with a variety of sterile fronds I do not recognize as this species. Other collections are: Pahang, *Holttum 20776*; Philippines, *Bur. Sci. 14804, 76496, Merrill 6088, 6089, Elmer 9747a, 11690*, from southern Luzon and Mindoro to Mindanao. Reported from Borneo and Sumatra.

Rhizome, stipe, and terete rachis are as slender as possible; pinnæ 1 to 4 on a side, the upper ones connected by wings; teeth variable in length and attenuation but never hairlike as on *H. johorense;* cell walls very thin; sorus on a contracted segment, sometimes almost stipitate, involucre narrower than the normal pinnæ, lips conspicuously toothed, receptacle, when full-grown and unbroken, more than twice as long as the involucre.

Not related to *H. peltatum* (*H. Wilsoni*). The suggestion of affinity to *Didymoglossum* (not *Hymenophyllum*) *affine* van den Bosch is probably correct.

37. HYMENOPHYLLUM JOHORENSE Holttum. Plate 15.

Hymenophyllum johorense HOLTTUM, Gardens' Bull. 4 (1929) 408, with fig.

Rhizoma tenue repens. Stipites 2–5 mm. longi, glabri. Frondes raro plus quam 1 cm. longae et 1 cm. latae; ramoli dichotomi fere regulariter; ramuli tertiarii plerumque praesentes, quaternati non visi. Ramuli ultimi 1.5–2 mm. lati, usque ad 9 mm. longi. Margines leviter crispatae, pilis simplicibus numerosis rufo-brunneis deciduis munitae. Valvae indusii extra pilosae, apice rotundatae, margine dentatae, dentes pilosi, basi angustatae et ⅓ basin versus conjunctae; receptaculum tandem indusium longe 1 mm. superante.

JOHORE: Gunong Belumut, 3,000 feet. (Holttum 10755), in a close mat on tree trunk, among liverworts.

Rhizome slender creeping. Stipes 2–5 mm. long, glabrous like the main veins. Fronds rarely more than 1 cm. by 1 cm.; branching almost equally dichotomous; branches of third order usually present, but of fourth order not seen. Ultimate branches 1.5–2 mm. wide, and up to 9 mm. long in unequally branched fronds. Edges slightly crisped, bearing numerous simple red-brown hairs, which are somewhat deciduous on old fronds. Valves of indusium with hairy outer surface, rounded above, and toothed, the teeth bearing hairs like the edges of the frond; narrowed below and united for ⅓ of their length, the base forming a conical sheath round the receptacle which in age projects 1 mm. beyond the indusium.

This is perhaps nearest to *H. borneense* Hk., of which I have seen the type at Kew. The latter species differs however in having more palmate fronds with more slender segments, which are very hairy, and the indusial lips are much smaller.—HOLTTUM, loc. cit.

I illustrate this by the type, kindly lent me for the purpose by Mr. Holttum. Perfectly identical with it are three collections from the central Philippines: *Copeland s. n.*, from the summit of Mount Maquiling in 1909, misnamed *H. subflabellatum*; *Bur. Sci. 28468*, from Tayabas; and *76554*, from Mount Isarog, Camarines Sur. It is reported from Mount Kinabalu, Borneo, by Holttum, Gardens' Bull. 7 (1934) 214. The paucity of collections is probably due less to rarity than to the fact that it is inconspicuous.

I would say that the stipe is commonly about the length of the lamina, 1 to 1.5 mm long; and that tertiary segments are more often absent. A striking feature is that with age the dark color spreads along the entire margin from the hair-bearing teeth, and that by the time the sporangia are mature the margin of the lips of the involucre is dark to a depth of commonly four cells.

As to its affinity: As repeatedly remarked, these minute species must be considered individually, remembering always that resemblances which must result from reduction are therefore poor evidence of affinity. In spite of this fact, I am tempted to regard this specimen as "*Microtrichomanes*," and do place it in *Meringium* chiefly because of its walls. Christensen, Gardens' Bull. 7 (1934) 214, says it is not related to *H. borneense*, but compares it with *H. Lobbii*, from which "it differs chiefly by its segments being twice as wide." I do not regard them as related. The species from which it does differ in this respect, and not otherwise, is *H. Armstrongii*.

It is also exceedingly similar superficially to small forms of *H. blandum*, and the resemblance forces itself on the attention when they are brought in together, from Mount Isarog in southern Luzon. I do not believe, though, that they are even nearly related, and surely neither is a near relative of *H. tunbridgense*.

27a. HYMENOPHYLLUM PERPARVULUM v. A. van Rosenburgh.

Hymenophyllum perparvulum V. A. VAN ROSENBURGH, Bull. Jard. Bot. Buitenzorg II No. 16 (1914) 18.

Typified by *Matthew 664*, from Mount Singgalong, Sumatra, not seen. A dwarf, fronds up to 15 mm long and 7 mm wide,

naked, the rachis winged upward; pinnæ crowded, 3 to 5 on a side, simple or forked, segments about 1 mm wide, irregularly spinulose-denticulate; sori few, in the upper axils, involucre deeply cleft, with obconic base, and spinulose-denticulate lips. Christensen has suggested that *H. johorense* is possibly a later name of this species.

28. HYMENOPHYLLUM REDUCTUM Copeland sp. nov. Plate 26.

Rhizomate 0.2 mm crasso, obscuro, nudo; stipite 0.6 ad 1.0 mm alto, filiforme, nudo, terete; fronde ca 2 cm longa, dichotoma ramis (segmentis) 3 ad 5, basi anguste cuneata in stipitem transeunte, segmentis 5 ad 12 mm longis, usque ad 2 mm latis, adscendentibus, serrulatis, dentibus paucis, spiniformi-protractis; cellulis subelongatis, parietibus ob interanea dense applicata difficilibus visu, ad superficiem frondis undulato-crenulatis præcipue ad convexitates crenulationis incrassatis, ibidem interdum denticuliferis; soris in apices segmentorum tubo immersis, involucro 2/3 ad basin fisso, tubo cuneato dorso setifero et obscure corrugato, labiis late rotundatis dentibus in filamenta protractis ornatis; receptaculo labiis æquilongo.

PHILIPPINES, NEGROS, Cuernos de Negros, altitude 1,800 m, *Elmer 9747*. Type in Copeland Herb.

Similar and probably related to *H. johorense*, from which it is distinguished, among other characters, by the more immersed base of the receptacle.

29. HYMENOPHYLLUM ROSENSTOCKII Brause. Plate 21, figs. 1 and 2.

Hymenophyllum Rosenstockii BRAUSE, Bot. Jahrb. 56 (1920) 63.

Rhizoma scandens, tenuissimum, glabrescens, juventute cum petiolo pilis rufis setaceis articulatis instructum, folia interstitiis 0.3-2 cm longis emittens. Petioli tenues, 2-6 cm longi, teretes. Lamina usque ad 2.3 cm longa, 1-2.2 cm lata, pellucida, glaberrima, e basi truncata deltoidea vel e basi cuneata ovata, profunde bipinnatifida; segmentis I 2-4-jugis, confertis, infimis maximis, 1.5 cm longis, interdum subhorizontalibus, reliquis patentibus, pinnatifidis; segmentis II linearibus, maximis furcatis, 0.8-1.4 mm latis, margine argute serratis; rachibus nervisque validis, prominentibus. Sori superiorem laminae dimidiam partem occupantes, parci, singuli in segmentis I, nervos laterales basilares terminantes, 1-3-jugi, ca. 2.5 mm longi, 1.2 mm lati, indusio cupuliformi, bilabiato, labiis dimidiam indusii partem occupantibus in apicem paulo angustatum, rotundatum, integrum vel leviter serratum desinentibus, receptaculo crasso, 3-4 mm exserto.

Nordöstl. Neu-Guinea: Kaiserin-Augusta-Flus-(Sepik-) Gebiet: Hunsteinspitze, lichter Gebirgswald, dunkelgrünes Hymenoph., kleine Äste ganz umwachsend, 1050 m ü. M. (Ledermann n. 8342.—19. Aug. 1912),—Etappenberg, 850 m ü. M. (Ledermann n. 9087 a.—8. Okt. 1912).

—BRAUSE, loc. cit.

By the courtesy of the Museum Botanicum Berolinensis, I have a sterile frond of the type collection. Its internal walls are hyaline, moderately nodulose-thickened in middle optical plane, indicating that they are shallowly reticulate-pitted; they are crenulate at the surface, and then thickened, and in places short-toothed. This structure indicates affinity to *H. holochilum* or *H. Meyenianum*, but there is nothing in the gross aspect of the frond to support this indication.

Hymenophyllum Rosenstockii has presumably been evolved by reduction, and more complete knowledge of the local fern flora is required to make clear its affinity.

30. HYMENOPHYLLUM HERTERIANUM Brause. Plate 21, fig. 2.

Hymenophyllum herterianum BRAUSE, Bot. Jahrb. 56 (1920) 43.

Leptocionium e *H. tunbridgense* (L.) Sm. affinitate. Rhizoma longe repens, filiforme, glabrescens, folia interstitiis 0.4–1.2 cm longis emittens. Petioli tenuissimi, glabri, teretes, 3–8 mm longi. Lamina e basi ± cuneata ambitu ovata vel deltoidea, 1–1.8 cm longa et lata, membranacea, pellucida, subbipinnatifida; segmentis 2–3-jugis, ala decurrenti ca. 0.5 mm lata conjunctis, infimis maximis, subhorizontalibus vel patentibus, furcatis, reliquis patentibus, linearibus; laciniis ca. 1.8 mm latis, margine acute serratis; nervis validis, prominentibus, simplicibus. Sori summam laminae partem occupantes, pauci, 2–3, nervos abbreviatos terminantes, indusio cupuliformi, bilabiato, labiis apice rotundato longissime dentatis, receptaculo valido, ca. 2 mm exserto.

Nordöstl, Neu-Guinea: Kaiserin-Augusta-Flus-(Sepik) Gebiet: Ettappenberg, dichter Höhenwald, blaugrünes Hymenoph. im Moospolster der Baumstämme, 850 m ü. M. (*Ledermann* n. 8869.—30. Sept. 1912).

—BRAUSE, loc. cit.

This is also represented by a type fragment from the Berlin Museum. The marginal teeth consist of two or three cells in sequence, on a short base two or three cells wide. The internal walls are hyaline, uniformly slightly thickened, pore-pitted only, somewhat dilated where they come to the surface. The evidence of the anatomy is like that of the sori, to the effect that the superficial similarity of vegetative *H. herterianum* and *H. Rosenstockii* is no proof of affinity.

31. HYMENOPHYLLUM DIMIDIATUM Mettenius.

Hymenophyllum dimidiatum METTENIUS, Linnaea 35 (1868) 398.

Rhizoma?; folia membranacea siccitate olivacea, glaberrima, pinnatisecto-pinnatipartita; petiolus vix ½" longus, teres, sub apice marginatus; rhachis segmentis decurrentibus basi interrupte anguste, superne manifeste continue alata; lamina 4½" longa, 9' lata, lanceolata; segmenta numerosa,

imbricata, patentia, dimidiato s. subdimidiato-oblonga s. ovata, obtusa, inferiora decrescentia, cuneata; laciniae 2–4, oblongae s. elongato-oblongae, obtusae, repando-dentatae, inferiores bifidae s. bisbifidae; sori lacinulam anticam infimam segmentorum superiorum occupantes, basi immersi, labia profunde distincta rotundata s. late oblonga, obtusissima, dentata s. fimbriato-dentata; receptaculum denique breve exsertum; paraphyses in basi receptaculi numerosae.

Nova Caledonia. (Deplanche in Herb. Lenormand.)

Ex folio unico descriptum, locum ad latus *Hym. secundi* Hk. Grev. capiat; segmentis minus manifesto-dimidiatis, laciniis numero minoribus magis divisis, soriferis solitariis, indusio obtusissimo fimbriato ab eo satis distinctum.—METTENIUS, loc. cit.

Rhizome 0.2 to 0.3 mm thick; stipe about 1 cm long, winged at the top, deciduously hairy; frond 5 to 10 cm long, lanceolate, bipinnatifid, rachis narrowly winged, without teeth, lowest pinnæ reduced, flabellate, middle ones nearly all dimidiate, with about two forked segments on the acroscopic side and none on the basiscopic; simple segments 3 to 8 mm long, 1.3 mm wide, serrate with spreading teeth near their apices, entire downward; cells mostly isodiametric or slightly elongate; marginal walls coarsely toothed on the inside; internal walls thin, straight, and, even in median optical section, dilated and toothed where they meet the superficial walls, and the teeth (thickened lines on the inside of the superficial walls), where best developed, becoming attenuate, eventually branching, and inclosing a row of large areolæ each with one chromatophore—this development of the walls not everywhere visible; sori immersed in obsolete axial segments, up to 3 mm long and 1.5 mm wide, cleft about halfway down, tube smooth, winged, lips broad with rather truncate, regularly laciniate-dentate apex; receptacle, so far as seen, included.

Endemic in New Caledonia.

Specimens: *Franc 1392, 1450; Ros. Fil. Nov. Caled. 138.*

An isolated species.

31a. HYMENOPHYLLUM SUBDIMIDIATUM Rosenstock.

Hymenophyllum subdimidiatum ROSENSTOCK, Meded. Rijks Herb. Leyden No. 11 (1912) 1.

From New Caledonia, typified by *Schlechter 14799*, not seen, and apparently not in the Leyden Herbarium. It is apparently similar to *H. dimidiatum*, but has entire lips of the involucre. Rosenstock's comparison of the two is practically useless, because *Schlechter 14757*, which he identified as *H. dimidiatum*, is the very different *H. Deplanchei*.

32. HYMENOPHYLLUM OVATUM Copeland. Plate 32.

H. (*Leptocionium*) *ovatum* COPELAND, Philip. Journ. Sci. § C 6 (1911) 70.

Rhizomate filiforme glabrescente; stipite 1 cm alto, rhachique sursum alata nigris, glabrescentibus; fronde ovata, 4 cm alta, 3 cm lata, obtusa; pinnis utroque latere ca. 9, proximis et interdum imbricatis, sessilibus; apice rotundatis, fere ad costam pinnatifidis; segmentis 1–2-lobatis, proximis; lobis ca. 0.8 mm latis, obtusis, sparse serratis, margine haud crispa, glabris, coriaceis, brunneis; indusio infra medium bifido, laciniis late ovatis, superne dentatis.

No. *B. 32*, Gira.

Clearly distinguished from all related species by the broad, very compact, and decidedly coriaceous little fronds.—COPELAND, loc. cit.

Still known by the type only. The published diagnosis contains one essential error; all costæ and veins are persistently ferruginous-hairy beneath, and naked and dark fuscous above. The hairs extend to the dorsal face of the tube of the involucre. The walls are very irregularly thickened and more or less (irregularly) toothed where they come to the surface.

In its coriaceous texture, fuscous color, and opacity, this is like a number of its New Guinea neighbors. It looks especially like an *Amphipterum*, but is without supplementary wings.

33. HYMENOPHYLLUM RUBELLUM Rosenstock.

Hymenophyllum rubellum ROSENSTOCK, Nova Guinea 8 (1912) 716.

Leptocionium; rhizomate tenui, longe repente, sparse paleaceo-piloso; stipitibus c. 6 cm. longis, ½ mm. crassis, erectis, firmis, teretibus, badiis, nitidis, laminis deltoideis, longe acuminatis, rhachibus costisque exceptis glaberrimis, in sicco obscure rubellis, 3–4-pinnatifidis, ad 12 cm. longis, 10 cm. basi latis; segmentis primariis c. 15 utrinque, alternis, approximatis, subsessilibus, patentibus, saepe recurvis, basalibus plerumque maximis, ad 5 cm. longis, 2 cm. infra latis, lineari-lanceolatis, acuminatis, sequentibus subaequalibus vel sensim minoribus, supramedialibus citius abbreviatis et simplicioribus, cum summis apicem sensim et longe angustatum efformantibus; segmentis secundariis pinnarum inferiorum elongato-oblongis, acuminatis, approximatis; segmentis tertiariis majoribus pinnatifidis; ceteris furcatis vel simplicibus; laciniis anguste linearibus, obtusis, ad 2–3 mm. fere longis, vix ultra ½ mm. latis, margine serratis vel deorsum integerrimis; rhachibus costisque elasticis, ala angusta, plana, integerrima cinctis, pilis ferrugineis sparsis ornatis; soris apicem laminae occupantibus, axillaribus, laciniam anticam, abbreviatam terminantibus; indusiis e basi conica leviter ventricosis, utrinque anguste marginatis, bilabiatis, labiis aequaliter trigonis, ⅓ sori longitudinem fere aequantibus, integerrimis.

Hab. Nova Guinea neerlandica in summo montium Hellwig-Gebirge dictorum, 2583 m. s. m. Oct. et Nov. 1909, I. von Roemer No. 767 et 1395.

Die durch kräftigen Wuchs ausgezeichnete Art steht dem *H. serrulatum* Prsl. am nächsten. Sie unterscheidet sich von ihm durch die deltoide Gestalt ihrer Spreite und die, besonders im durchfallenden Licht, entschieden

rötliche Färbung des die starken, dunklen Rippen nur schmal umsäumenden Blattparenchyms. Auch sind die Lippen des Indusiums bei *H. serrulatum* länger (fast halb so lang als das ganzen Indusium).

—ROSENSTOCK, loc. cit.

A cotype, smaller than as described, is in the Herb. Lugd.-Bat. I have not ventured to study the sorus, as only one is present. The walls are thick and pitted.

This seems to me to be an isolated species, with the aspect of *Trichomanes* § *Macroglena*, rather than of any *Hymenophyllum*. The marginal teeth are very few, and the majority of what there are are single, obliquely protruding cells.

34. HYMENOPHYLLUM FIRMUM v. A. van Rosenburgh.

Hymenophyllum firmum v. A. VAN ROSENBURGH, Nova Guinea 14 (1924) 28.

Hymenophyllum subfirmum v. A. VAN ROSENBURGH, Nova Guinea 14 (1924) 28.

Leptocionium.—Rhizoma longe repens, gracile, cum stipitibus, rachidibus, costis venisque pilosum; pili partim decidui, partim persistentes, articulati, ferruginei, acuti; pili rhizomatis copiosi, longissimi, ceteri sensim minus numerosi, breviores. Stipites sparsi, 7½–15 cm. longi, parce punctato-verruculosi, parte inferiore nigri, parte superiore anguste 2-marginati, cum tota fronde obscure virides, in sicco nigri. Frondes firmae, potius coriaceae, costis venisque exceptis glabrae, ovato-lanceolatae ad deltoideae, 10–15 cm. longae, 5–15 cm. latae, acuminatae, basi 3-pinnatae; rachis basin versus 2-marginata, apicem versus anguste alata. Pinnae suberectae ad patentes, 14–18 utrinque; pinnae superiores breves, simplices vel furcatae; pinnae inferiores lineari-lanceolatae, usque 7½ cm. longae, ad vel supra basin 1 cm. latae; rachis anguste alata, ala integerrima. Pinnulae in pinnis longioribus usque 12 utrinque; pinnulae superiores simplices vel furcatae, inferiores ovatae vel oblongae, fere usque ad costam incisae, ala integerrima. Segmenta tertiaria in pinnulis majoribus 2–4 utrinque, maxima furcata vel duplicato furcata. Segmenta ultima breviter oblonga ad breviter linearia, 1–5 mm. longa, ½ mm. lata, obtusa, remote et obtusiuscule serrulata, hic illic integerrima. Sori in pinnis 1–4, in pinnulis axillares, solitarii, magni; indusium clavato-obovoideum, quam segmenta ultima ± 3-plo latius, obscure viride, in sicco nigrum, ⅔ usque ad medium 2-valvum, basi obconoideum, cristis longitudinalibus, longioribus vel brevioribus et (vel) appendicibus ascendentibus vel erectis munitum; valvae breviter oblongae, integerrimae vel leviter re-pandulo-denticulatae, apice obtusiusculae ad rotundatae; appendices breves dentiformesque vel elongatae sublinearesque, decidue ferrugineo-piliformi-apiculatae; receptaculum inclusum vel ± exsertum.

Habit.: Mountain ridge near Doorman Summit, epiphytical in forest, alt. 2480 m., H. J. Lam n. 1944, 10 November 1920.

—V. A. VAN ROSENBURGH, loc. cit.

The Herb. Lugd.-Bat. contains a cotype of *H. firmum;* also, *Drs. v. Leeuwen 10847,* Nassau-Geb., altitude 2,500 m, sterile, is the same species.

It is well characterized by the large fronds, long and narrow basal pinnæ, and narrow segments, with teeth mostly too small to be visible without a lens. The black dried fronds with opaque lamina are a local Papuan feature, as characteristic as is the odor of many New Zealand species. Cells mostly more or less elongate, contents fuscous, opaque, walls apparently hyaline, in spots evenly thin, but in most places crenate and nodulose-thickened, those of the *v. Lecuwen* specimen more thickened than those of the cotype. Involucre cleft one-third to halfway down, with broadly rounded, usually entire lips; tube always bearing coarse hairs at the base on both sides, sometimes with salient or reflexed teeth on one side, and rarely with ribs.

In spite of the teeth on the tube, it is on the whole nearer to *H. Meyenianum* than to *H. denticulatum*.

Both described by van Alderwerelt, *H. firmum* and *H. brevidens*, which I have not seen, are presumably distinct; in their descriptions the resemblances are more striking than the differences.

Hymenophyllum subfirmum, collected on the same trail but a thousand meters lower, does not seem to me possibly to be a distinct species. It is a little larger, a little more divided, not so nearly black; but these are differences in degree, and minor. The involucres are narrower, but the difference is not greater than is often found in other species. Found as they are, near together, I cannot doubt that more complete collection will show that they blend.

31. HYMENOPHYLLUM FOERSTERI Rosenstock. Plate 11.

Hymenophyllum Foersteri ROSENSTOCK, Fedde's Repert. 12 (1913) 165.

Leptocionium; rhizomate repente, filiformi, pilis ferrugineis hirsuto; stipitibus 2–3 cm inter se remotis, brevibus (1–2 cm longis), hirsutis, infra teretibus, sursum anguste marginatis; laminis c. 15 cm longis, 1–1½ cm vel paullo ultra latis, linearibus, apice breviter acuminatis, membranaceis, in sicco lutescentibus, hirsutis, pinnato-pinnatifidis; pinnis numerosis, erecto-patentibus, alternis, breviter petiolatis (petiolis decurrenti-marginatis) trapezio-oblongis, obtusis, profunde pinnatifidis, ad 1½ cm longis, 6–7 mm latis; segmentis conceatis vel linearibus, in lacinias 1–2 lineares fissis vel simplicibus; laciniis ad 2–3 mm longis 1 mm fere latis, margine dentibus membranaceis, e basi latiuscula acuminatis pilisque longis ferrugineis ornatis; rhachibus tenuibus, flexuosis, interrupte marginatis, cum costis venisque utrinque dense ferrugineo hirsutis; soris omnes fere pinnas occupantibus, solitariis, axillaribus; indusio conico, anguste marginato, usque ad ⅓ vel ½ bilabiato, dense hirsuto, labiis rotundatis, margine longe ciliatis.

Nova Guinea germanica, in montibus Bolan dictis, 3400–3800 m alt.; 1912, *L. C. Keyser, no. B. 81.*

Durch die dichte rostfarbige Haarbekleidung von den übrigen Arten der Untergattung *Leptocionium* leicht zu unterscheiden.—ROSENSTOCK, loc. cit.

Judging by the cotype in the University of California Herbarium, this is an excellent description. One frond is forked several times in the upper part. The marginal teeth are about horizontal, and consist each of a distal filament of three to eight short cells, on a broader base of varying length and width. They are unlike the teeth of any *Leptocionium*, and I do not suppose that this species belongs in that group. All axes are beset sparingly on the upper side, densely on the nether, with a tangle of weak, rusty hairs, three to eight cells long, and with a maximum length of at least 4 mm. The cells of the lamina are large, with thin, even walls. The sori are in the position of suppressed lowest acropetal pinnules, slightly winged at the base only; involucre 2.5 to 3 mm long, cleft less than halfway down, the tube black and variously warty near the base and everywhere hirsute, lips broadly rounded, densely ciliate with hairlike teeth, like those of the margin but with the bases almost obsolete; receptacle as long as the tube, cylindric, without sporangiophores.

Known by the type collection only.

An isolated species, with more the appearance of *Sphaerocionium* than of *Leptocionium*, and with the receptacle of *Eu-hymenophyllum*.

16. HYMENOPHYLLUM VIRIDE Rosenstock. Plate 24.

Hymenophyllum viride ROSENSTOCK in Herb. Lugd.-Bat., sp. nov.

Ab H. Macgillvrayi differt, fronde glabra, segmentis majoribus, receptaculis ut videtur inclusis. Stipite ca. 1 cm alto, gracile; fronde 5 cm alta, 1.5 cm lata, bipinnatifida, pinnulis infimis acroscopicis interdum furcatis, rhachi anguste alata, segmentis 3 ad 5 mm longis, 1.5 mm latis, serrulatis; parietibus tenuibus apud superficiem irregulariter subcrenulatis vix incrassatis; soris infra apicem frondis in segmenta fere obsoleta basi immersis, involucro 2.5 mm longo, obovato, medio fisso, labiis integris vel subintegris, rotundatis vel obtuse apiculatis.

New Celedonia, montibus prope Yaoube, altitude 500 m, *Schlechter 14799.* Type in the Herb. Lugd.-Bat.

This species and *H. Macgillvrayi* may belong in the group of *H. pellatum*, rather than in *Meringium*.

37. HYMENOPHYLLUM MACGILLIVRAYI (Baker) Copeland comb. nov. Plate 25.

Trichomanes Macgillivrayi BAKER, Ann. Bot. 5 (1891) 195.

Rhizome filiform, wide-creeping. Stipe slender, filiform, under an inch long. Frond oblong-lanceolate, bipinnatifid, glabrous, 1½–2 in. long; rachis winged down to the base; pinnae crowded, oblong-lanceolate, sharply serrated; secondary segments small, oblong. Sori one to a pinna, placed near the base on the upper side; indusium with a campanulate tube, and suborbicular entire lips. Fiji, *Macgillivray*. Near the Bornean *T. denticulatum* Baker.—BAKER, loc. cit.

Rhizomate intricato, 0.3 mm crasso, piloso pilis deciduis; stipite ca. 2 cm alto, gracillimo, ut rhizomate piloso; fronde usque 7 cm alta, 2 cm lata, bipinnatifida pinnulis majoribus acroscopicis furcatis v. bis furcatis, rhachi deorsum marginata sursum anguste alata, inferne pilulifera, segmentis brevibus vix 1 mm latis, inconspicue serrulatis; cellularum parietibus rectis tenuibus apud superficiem subsinuatis; soris segmenta acroscopica brevia impositis, involucro 2.5 ad 3 mm longo, medio fisso, tubo basi immerso, inferne decidue pubescente, labiis aut subacutis integris aut rotundatis et integris vel sinuatis, receptaculo valido prolongato.

FIJI, *J. Horne* (*521*), collected in 1877–78. Distributed as *H. tunbridgense*, from which it differs, *inter alia*, in the mostly entire lips and long-extruded receptacles. In spite of these receptacles, the affinity to this group, particularly to *H. peltatum*, may be real.

After describing the *Horne* specimen as new, I have concluded that it can hardly be other than identical with that described in the wrong genus by Baker. However, I have not seen Baker's type.

38. HYMENOPHYLLUM GUIGUINEUM Copeland sp. nov. Plate 26.

Rhizomate ad truncos arborum scandente intertexto, 0.5 mm crasso; stipite 2 ad 3 cm alto, tereto, pilis rufis sparsis obsito; fronde ca. 8 cm longa, ovata, tripinnatifida, rhachi deorsum tereta sursum alata pilifera, pinnulis inferioribus flabellato-incisis superioribus dimidiato-pinnatifidis segmentis aut simplicibus aut furcatis paucis, brevibus, simplicibus ca. 0.7 mm latis, aculeato-serratis; parietibus marginalibus dentibus conspicuis irregularibus incurrentibus ornatis, internalibus in loco mediale nodoso-inerassatis, apud superficiem crenato-inerassatis denticuliferis; soris axillaribus sessilibus, involucro ca. 3.5 mm longo, vix ad medium fisso, tubo anguste obconico, marginato, utraque facie ad basin pilosa, deinde dentibus plerumque II longis crasse

piliformibus ornato, labiis rotundatis denticulatis vel subintegris, receptaculo non v. vix exserto.

SOLOMON ISLANDS, Ysabel, Tiratoña, altitude 600 m, *Brass 3304* (type in Phil. Nat. Herb.).

Except that the pinnules are less deeply cut, this looks like *H. multifidum*, *H. feejeense*, and *H. Deplanchei;* but in cellular structure and the cristate tube of the involucre it is more like *H. denticulatum* and Malayan species in general.

35. HYMENOPHYLLUM FEEJEENSE Brackenridge. Plate 27.

Hymenophyllum feejeense BRACKENRIDGE, U. S. Expl. Exped. 16 (1854) 266, pl. 27, fig. 2, *a, b, c.*; COPELAND, Univ. Calif. Publ. Bot. 12 (1931) 388.

H. stipitibus gracilibus teretibus glabris; frondibus late ovatis acuminatis pinnatis; pinnis alternis patentibus ovato-oblongis bi-tripinnatifidis, laciniis anguste-linearibus obtusis spinuloso-dentatis; rhachi flexuosa sursum marginata; soris terminalibus vel supra-axillaribus; indusio ovato bipartito, valvis superne argute serratis; receptaculo incluso.

HAB. Ovolau, Feejee Islands: on moist rocks and trees, at the elevation of 2,000 feet.

Plant very abundant in the above localities. Rootstock setose. Stipes 3 inches and upwards in length, *slender, smooth, terete. Fronds* usually about the same length as the stipe, elastic, *broad-ovate*, contracting into an *acuminate* point, *pinnate*, at least near the base, where the main rhachis is occasionally slightly margined, and usually with the secondary rhachis a little *flexuose. Pinnae alternate, spreading, ovate-oblong;* the inferior ones distant and tripinnatifid; the superior bipinnatifid; the *laciniae* short, *narrow-linear, obtuse, spinulose-dentate. Rhachis flexuose, margined* towards the upper portion. *Sori* few, confined to the upper half of the frond, and situated either on short *supra-axillary* laciniae, which is their usual position, or on the points of the outer laciniae. *Indusium* small, ovate, and split into *two valves* almost to its base, which is slightly immersed in the lacinia, the upper half of the valves *sharply serrated. Receptacle included.*

In habit and general characters this stands near to *H. bivalve*, Swartz; but it differs from that species in its slightly margined rhachis, and the sharply serrated indusium.—BRACKENRIDGE, loc. cit.

The type, in U. S. Nat. Herb., is very exactly matched by *Parks 20808* from Viti Leou, in most large herbaria; also *im Thurn 24* in U. S. Nat. Herb.? ex Herb. Kew.

In size and general appearance this is remarkably like *H. multifidum*, with which it agrees also in cell structure. The rachis is more narrowly winged, but the wing bears remote teeth where wide enough. The segments are a scant millimeter wide, and not quite so distinct at the base—that is, the sinuses are somewhat webbed. The fructification, however, is so different that I do not understand its reduction to *H. multifidum*, by

Baker in the Synopsis, and Christensen in the Index. The fertile segments are short but very evidently present, the involucre is much shorter, above 1.5 mm long and nearly as wide, cleft fully two-thirds of the way down, the lips thinner, broadly rounded or narrowing slightly upward, and conspicuously lacerate-dentate. The receptacle protrudes slightly on a few sori; in older material this might be more evident.

Fiji, as already cited. Sterile specimens from Samoa, *Vaupel 455*, and Aneityum, *Kajewski 871A*, may be this species.

40. HYMENOPHYLLUM PRAETERVISUM Christ. Plate 28.

Hymenophyllum praetervisum CHRIST, Engler's Bot. Jahrb. 22 (1896) 338.

Frons Hymenophylli tunbridgensis, soris 6 ad 8 terminalibus pedunculatis, apici segmentorum insertis infundibuliformibus, versus basin attenuatis, versus limbum campanulato-patentibus, profunde bilabiatis denticulatis saepe labiis reflexis, receptaculo longo et crasso exserto.

Zierliche Rasen an Farnstämmen bildend.

Savaii, Ostgebiet, 1000 m (Reinecke s. n.). Upolu, Kamm- und obere Flussgebiete (R. n. 63), Letogofluss-Falefaflussgebiet (R. n. 88), Falevaokessel (R. n. 88'). Tutuila, Matafaoflussbett, 500–600 m (R. n. 88b). Manua-Inseln (R. n. 88').—CHRIST, loc. cit.

Rhizome wide-creeping, wiry, black, glabrescent; stipe 1.5 to 2.5 cm long, filamentous, naked, frond 2 to 4 cm long, 1.5 to 2.5 cm wide, bi- or tripinnatifid, rachis hardly marginate below, narrowly winged upward, segments up to 4 mm long, 1 mm wide, sharply serrate, teeth of one to three seriate cells on a broad base; internal walls hyaline, straight, slightly and uniformly thickened, unchanged at the surface; sori confined to the apex of the frond, one to eight in number, involucre 2 to 2.5 mm long, 1 mm wide, cleft one-third to one-half of the way down, tube narrowly obconic, base deciduously hairy, hardly at all winged, lip broadly or narrowly triangular, minutely but sharply toothed, receptacle exserted.

Specimens: SAMOA, *Reinecke 63, 88, 88, 88b; Whitmee 28; Betche.*

Domin, Bibl. Bot. 20 (1914) 21, doubtfully refers to this species a var. *australiense, H. tunbridgense* var. *exsertum* F. M. Bailey, Lithog. Ferns Queensland (1892) pl. 30. So far as Bailey's illustration and Domin's comments show, it might well be this species, but authentic specimens show that it is a distinct species—*H. pseudotunbridgense* Watts.

In describing *H. praetervisum*, Christ confused with it an entirely different Bornean plant mistakenly [cf. Christensen,

Mitt. Inst. Bot. Hamburg 7 (1928) 143] named *Trichomanes denticulatum* Baker.

Hymenophyllum praetervisum is a small representative of the austral group of *H. multifidum*.

43. HYMENOPHYLLUM MINIMUM A. Richard.

Hymenophyllum minimum A. Richard, Fl. Nouv. Zél. (1822) 91, 14, fig. 2; van den Bosch, Ned. Kruid. Arch. 5[1] (1863) 175; Colenso, Trans. New Zealand Inst. 13 (1881) 376 ff.; Holloway, Trans. N. Z. Inst. 54 (1923) 592, *pl. 67*.

H. perpusillum, surculis repentibus; fronde petiolata, pinnatifida purpurea, laciniis inferioribus profunde bipartitis obtusis argute serratis, indusio oblongo terminali, obtuso, semibivalvi, margine dentato.

Crescit in Nova-Zeelandia. (v. s. s.)

Descriptio.

Caespitosum, surculis ramosis radicantibus, filiformibus, subsquamatis, squamis linearibus raris.

Frondes erectae, solitariae petiolatae, vix unguiculares (petiolo tereti, 1–2 lineas longo), pinnatae, laciniis inferioribus profunde bipartitis, oblongis obtusis margine argute serratis glaberrimis purpureis, medio longitudinaliter plicatis. Indusium frondem terminans, solitarium subpedicellatum, basi sensim angustatum spinulosum, apice obtusum semibivalve, valvis margine dentatis. Sporangiophorum inclusum subpedicellatum, apice muticum.

Observations.

Cette espèce est probablement la plus petite de tout le genre. Elle forme des touffes serrées qui croissent mélangées au milieu des Mousses et des Lichens. Elle se rapproche par son port des *Hymenophyllum pusillum* Gaudichaud, et *H. tunbridgense*. Mais elle diffère du premier par ses frondes offrant des dents très-aiguës, et du second par la forme de ses frondes simplement pinnées, à dents très-aiguës, et surtout par la forme et la position de son *indusium* qui est terminal et non placé le long des nervures comme dans la seconde espèce.—Richard, loc. cit.

I have seen no original specimen. Van den Bosch does not say that he saw one, and there is no fragment in his herbarium; but he must have had one, because he cites Herb. Franq. and notes "bona" as to Richard's figures, and because his unpublished notes amplify these. By means of his (van den Bosch's) sketches, and not otherwise, I can confirm the identification of a Stewart Island collection, *Kirk 574*, in U. S. Nat. Herb. J. D. Hooker had already reported it there, but it seems clear that neither Hooker ever saw an authentic specimen. The elder Hooker reduced both this and *H. antarcticum* to *H. tunbridgense;* regarding the two reduced species, van den Bosch well says, "Tanta autem illarum est diversitas, ut ne unico charactere inter

se convenient." The best discussion of *H. minimum* is by Colenso, who likewise avowedly never saw it.

Sterile fronds vary from simple and about 5 mm long, through bifid and bifoliolate to pinnate with up to four pinnæ on a side, the fronds 1 cm long; rachis in the most ample specimens hardly marginate at base, black; undivided pinnæ 3 to 4 mm long, 2 mm wide, obtuse or truncate, margin armed with spinulose teeth; walls thick and pitted; sorus terminal, involucre variable in size and shape, commonly obovate and 2 mm long, sometimes narrower and longer, cleft less than halfway down, base cuneate and wingless, with spinulose teeth on the back, lips broadly rounded, with long, fine teeth, receptacle exserted.

Described from New Zealand, probably Tasman's Bay; credited to Lord Howe Island by Bentham; seen from Stewart Island.

42. HYMENOPHYLLUM ARMSTRONGII Kirk. Plate 29.

Hymenophyllum Armstrongii KIRK, Trans. New Zealand Inst. 10 (1878) XLIII, *pl. 21, fig. A*, (not seen).

Trichomanes Armstrongii BAKER, Syn. Fil. (1868) 452; ed. 2 (1874) 465.

Hymenophyllum melanocheilos COLENSO, Trans. New Zealand Inst. 17 (1884) 255.

T. Armstrongii, Baker; *rhizome* capillary, wide-creeping; *st.* filiform, ½–1 in.; *fr.* ½ in. l., simple or forked or flabellately divided, with few blunt simple or lowest rarely forked 1-veined ligulate erecto-patent divisions, ⅓–½ in. br.; border as distinct as the midrib, bristle ciliated; *surfaces* glabrous; *sori* 1–4 to a frond, terminal on the lobes, minute, obconical, immersed, with rounded ciliated lips.

Hab. New Zealand, *Armstrong.*—BAKER, Syn. Fil. (1874) 465.

From the other minute species described from the same region—*H. minimum* Rich., *H. Moorei* Baker, *H. pygmæum* Colenso—this is clearly distinguished by being dichotomous or flabellate, not pinnate or pinnatifid. The others all represent the group which has been called *Leptocionium;* but this is ciliate instead of toothed, and is a *Microtrichomanes*, or dwarfed *Sphærocionium*. It is thus somewhat related to the other species which it most resembles, *H. johorense*, of the Malay region, from which, however, it differs essentially in having uniformly thin walls. The available material is so fragmentary and so nearly sterile that I have not examined the receptacle. The sporangium is that of a real *Hymenophyllum*.

The U. S. Nat. Herb. contains *Kirk 138* and *583*.

I have not seen *H. melanocheilos*, but accept the reduction already made, having arrived at it myself by description. Co-

lenso called it a relative of *H. marginatum*, but a *Pachyloma* with toothed margin is hardly possible.

Endemic in New Zealand.

41. HYMENOPHYLLUM MULTIFIDUM (Forster) Swartz. Plate 20, figs. 1 to 3.

Hymenophyllum multifidum (Forster) Swartz, Schrad. Journ. 1800[2] (1801) 102, Synopsis 149, 378; Schkuhr, Krypt. Gew. 133, *pl. 135, b*; Hooker and Greville, Ic. Fil. *pl. 167*.
Trichomanes multifidum Forster, Prodromus (1786) 85.
Hymenophyllum truncatum Col., Trans. N. Z. Inst. 23 (1890) 390.
Hymenophyllum alpinum Col., Trans. N. Z. Inst. 31 (1898) 263.
Hymenophyllum oligocarpum Col., Trans. N. Z. Inst. 31 (1898) 264.

T. multifidum, frondibus decompositis: foliolis alternis pinnatis: pinnis dichotomis linearibus decurrentibus argute serratis: fructificationibus ovato-subrotundis dehiscentibus. F.—Forster, loc. cit.

Frond. decompositis, pinnis decurrentibus dichotomis, laciniis linearibus argute serratis; soris supraaxillaribus solitariis. (*H. fucoidis affine.*)

, *Trichomanes multifidum*. Forst. prodr. n. 473. Ins. maris pacifici.—Swartz, Synopsis 149.

Stipites e surculo filiformi, repente, longi, filiformes, laxi, teretes, glabrae.

Frondes subtriangulares, acutiusculae, 2–3-pollicares decompositae, 3-pinnatifidae, glabrae, curvatae, diaphanae. *Rhaches* flexuosae, marginatae.

Pinnae decurrentes, patentes, dichotomae remotiusculae, pinnulis distinctis.

Laciniae lineares, angustae, apice obtuso integro, margine argute serratae.

Fructificationes supra axillas pinnarum et pinnularum solitariae insidentes, majusculae. *Columella* inclusa.

Valvulae indusiorum obovatae, compressae, integerrimae.

Observatio.

Affine *H. fucoidi* at diversum: forma frondis–*Laciniis* multo angustioribus et *valvulis indusii* integerrimis.

Ab. *H. bivalvi* situ fructificationum etc.—Swartz, Synopsis 378.

Fronds commonly 6 to 10, but sometimes up to 20 cm long, usually broadly ovate with broad base, glabrous or nearly so, rachis narrowly winged, the wing sparsely serrated with conspicuous teeth, large fronds quadripinnatifid, the segments linear, about 0.7 mm wide, the lamina usually not widened in the axils, serrate with prominent, rather remote teeth; cell walls uniformly thin and straight; sori on very short axillary segments, or terminal in very full fruit, involucre about 3 mm long, 1 to 1.5 mm wide, cleft about one-third (rarely, one-half) of the way down, the tube marginate on the sides, the lips wider than the tube and widening upward or less commonly narrowed, the lip entire or rarely with one or two irregular teeth. The plant bears faintly the odor of *H. sanguinolentum*.

Hooker, Sp. Fil. 98, notes a variety, B, on rocks, with "fronds scarcely an inch long." He also says "lips entire or serrated." I discuss under *H. revolutum* a dwarf with toothed lips, which, having also broad and short segments, looks to me more like that species, although mixed with small *H. multifidum*. The reductions of Colenso's species are made by Cheeseman, and tacitly accepted by Holloway, Trans. N. Z. Inst. 54 (1923), whose plate 69 illustrates the plasticity of the species.

NEW ZEALAND, many collections. A specimen from Lord Howe Island, *Watts*, in Queensland Herb., seems to be identical. Specimens bearing this name from many other islands seem to me all to be distinct. One from Samoa is sterile and might be this species, but is more likely to be *H. fecjeense*. Also, from Ancityum, *Kajewski 871A*, sterile, is possibly *H. multifidum*.

44. HYMENOPHYLLUM BIVALVE (Forster) Swartz. Plate 20, figs. 4 to 6.

Hymenophyllum bivalve (Forster) SWARTZ, Schrad. Journ. 1800' (1801) 99 (not seen), Synopsis 146, 372; SCHKUHR, Krypt. Gew. 132, *pl. 135, b*; HOOKER, Sp. Fil. 1: 98, *pl. 35, D*.

Trichomanes bivalve FORSTER, Prodromus (1786) 84.

Sphaerocionium bivalve PRESL, Hymen. 126.

Trichomanes pacificum HEDWIG, Fil. (1803) (not seen).

Hymenophyllum spathulatum COLENSO, Tasm. Journ. 2 (1844) 154.

Hymenophyllum pyriforme VAN DEN BOSCH, Ned. Kruid. 5' (1863) 173.

T. bivalve, frondibus subbipinnatis: pinnis alternis decurrentibus dichotomis, segmentis linearibus serratis, fructificationibus subrotundis bivalvibus. F.—FORSTER, loc. cit.

Stipes semispithameus, filiformis, teres rigidus, fuscus, nigricans.

Frons oblonga, acuminata 2-pinnata glabra, sicca circinalis, recens subdiaphana quasi a vesiculis distinctis pellucidis conflata.

Rachis flexuosa, marginato-alata.

Pinnae alternae, ovato-acuminatae, decurrentes dichotomae.

Pinnulae lineares, obtusae denticulato-serratae.

Sori ad apices pinnularum solitarii globosi. *Columella* conico-cylindracea, exserta.

Indusia ovato—l. subrotundo-ventricosa, valvulis integerrimis connivantibus, pinnulae cui insident latiora.

Observatio. Laciniis s. pinnulis denticulato-serratis ab *H. elevato* facile distinguitur.—SWARTZ, Synopsis 372.

Very much like *H. multifidum*. The proposed distinctions are—

1. That *H. bivalve* is "subbipinnate," *H. multifidum* more compound; if this distinction holds, practically all specimens called *H. bivalve* are misnamed.

2. That the receptacle of *H. bivalve* is exserted; it is rarely so.

3. That the sori of *H. bivalve* are terminal, those of *H. multifidum* supra-axillary.

4. That the sori of *H. bivalve* are roundish, those of *H. multifidum* more elongate.

If the specimens in hand are correctly named, and if I understand the species—which may not be so, as I have not seen a *Forster* specimen—*H. bivalve* has uniformly roundish involucres, 1.5 to 1.8 mm long, which are "terminal," not on pinnæ, but on segments, usually remote from the margin of the frond and not much shorter than the adjacent sterile ones, while those of *H. multifidum* are larger and longer, and borne on much shortened segments. The fronds as a whole are so alike that I do not illustrate that of *H. bivalve*. It has the odor of other New Zealand species.

Specimens: NEW ZEALAND, *Kirk 560, Cheeseman 303, Sledge 345, Thomson, Green, Tryon, Setchell, Holloway, Hooker.* AUSTRALIA, New South Wales, *Baüerlen*; Queensland, Roberts Plateau, *Shirley.*

The Philippine plant given this name by J. Smith, *Cuming 264*, is *H. Meyenianum.* In the Hooker collections, *H. bivalve* and *H. multifidum* may have been confused; at any rate, as to sterile ones bearing both names, I cannot guess which is correct.

Hymenophyllum pyriforme was described with "parietibus incrassatis hyalinis pulchre regulariter crenulatis;" while *H. bivalve* should have them "rubellis diaphanis spinuloso-dentatis." The distinction is verbal, the two expressions denoting different manifestation of the same type of thickening. The unpublished sketches of van den Bosch show perfectly smooth and straight walls, and the crenate or toothed walls, for both species. The distinction between perfectly even walls, and the crenate-thickened or toothed walls, is usually specific, at least if it characterizes whole fronds. Of the specimens cited, half have the walls completely undifferentiated, and half have them typically thickened.

43. HYMENOPHYLLUM TRIANGULARE Baker.

Hymenophyllum triangulare BAKER, Syn. Fil. (1867) 69; Hooker's Ic. Pl., 1613.

H. mannianum KUHN, Fil. Afric. (1868) 40.

St. 2–4 in. l., smooth, naked; *fr.* ovate-triangular, tripinnatifid, 4–6 in. l., 2–3 in. br. at the base; *main rachis* winged above; the *second rachis* broadly winged throughout; *pinnæ* rhomboidal-lanceolate; *lowest pinnl.* deeply pinnatifid, with simple or forked conspicuously spinuloso-dentate linear *segms.*, 2–3 in. l.; *sori* usually solitary, placed on the upper pinnæ

at the base of the anterior pinnule at the outer side; *involucre* large, ovate, fully a line deep, divided about halfway down; *valves* nearly entire. H. Mannianum, *Mett.*

Hab. Fernando Po, *Mann*, 333.—Much resembling *H. multifidum* and *bivalve* in habit, but the segments are broader, and the sori are much larger and usually solitary. It is the only *Leptocionium* which has yet been found in Tropical Africa.—BAKER, Syn. Fil. 2d ed. 69.

Hymenophyllum mannianum is a name published a year later based on the same collection. I have not seen this collection, but the species seems to be represented by three collections from Kamerun: *Zenker 3879*, *Staudt 43*, and *Gocker 140*, all in U. S. Nat. Herb.

The wing on the rachises bears long, spinelike teeth. The internal walls are not clearly visible in middle optical section, and are therefore presumed to be thick and pitted; coming to the surface, they are crenulate, thickened, and toothed, similarly to *H. edentulum;* not many sori are present, and I have been able to detect just one protruded receptacle.

The deltoid fronds on long, very slender stipes make this species as distinct in appearance as it is geographically.

2. Subgenus AMPHIPTERUM Presl

Amphipterum PRESL, Epim. (1852) 238, *nomen*, as genus.

Altior evolutionis gradus est ille, si raches costaeque venaeque ala foliacea libera bilaterali serrata in pagina superiori frondis instructae sunt.—Talem organisationem exhibet inter Trichomannoideas Amphipterum fuscum (Trichomanes fuscum Blume, . . .).—PRESL, loc. cit.

Frondibus pinnatim decompositis, rhachi hirsuta, venis aut inferne aut utraque facie alatis vel cristatis; margine aut serrulata aut integra; soris magnis segmenta axillaria abbreviata tertiaria (vel sursum secondaria) terminantibus, involucro vix ad mediam longitudinem bilabiato, deorsum cristato vel laminato, receptaculo valde extruso.

Nearly related to *Meringium*. I would not consider it expedient to distinguish it generically or otherwise if the wings on the veins were the only distinction; but *A. fuscum* is no less peculiar in its combination of cristate involucre and entire margin. Accessory laminar outgrowths of the axis are known in several American species which I regard as phyletically remote; but in the case of *A. laminatum* and *A. geluense* I believe this common structural feature is evidence of real affinity. While I would not regard these outgrowths as a very sufficient generic character, they serve well for the recognition of the group. Van den Bosch, Hymen. Javan. 64, was disposed to agree with Presl

on the generic distinctness of his *H. fuscum*, but would have placed it in Didymoglosseæ. In drying, the frond curls downward, but the sides of the segments are raised, in the manner familiar in *Gonocormus*.

Four species. Range: Sumatra to New Guinea.

Key to the species of the subgenus Amphipterum.

Margin entire.
- Nether surface lamellate ..... 46. *H. fuscum*.
- Both surfaces lamellate ..... 47. *H. Ledermanni*.

Margin serrulate; both surfaces lamellate.
- Rachis stout, hirsute ..... 48. *H. gehrense*.
- Rachis slender, glabrescent ..... 49. *H. laminatum*.

46. HYMENOPHYLLUM FUSCUM van den Bosch. Plate 31.

Hymenophyllum fuscum VAN DEN BOSCH, Hymen. Javan. (1861) 62, *pl. 51, 52 B*.

Trichomanes fuscum BLUME, Enum. (1828) 225.

Amphipterum fuscum PRESL, Epim. Bot. (1852) 258.

Didymoglossum fuscum HASSKARL, Fil. Javan. 2 (1857) 19.

Hymenophyllum dipteroneuron A. Br.: KUNZE, Bot. Zeit. 5 (1847) 225.

Hymenophyllum zollingerianum KUNZE, Bot. Zeit. 6 (1848) 305; VAN DEN BOSCH, Hymen. Javan. 61, *pl. 60, 52 A*.

Didymoglossum zollingerianum HASSKARL, Fil. Javan. 2 (1857) 20.

T. fronde pinnata lanceolata diaphana, pinnis alternis subsessilibus (superioribus adnatis) ovalibus obtusis basi truncatis lobato-pinnatifidis ad costam utrinque paleaceo-hirsutis, lobis incisis, rachi supernc marginata stipiteque teretiusculo ferrugineo-hirtis.

Crescit in Javae montibus excelsis.—BLUME, loc. cit.

Van den Bosch distinguished *H. fuscum* from *H. Zollingerianum* by "habitus minus laxus, rhachis, excepta basi, manifeste alata, laciniae minores lacinulaeque angustiores, cristae membranaceae ubique in fronde valde conspicuae latae, contextus laxior e cellulis majoribus minus opacis undulatis, etc." He expressed doubt as to the constancy of these criteria; Hasskarl, op. cit. 20, questioned the specific distinctness; the Synopsis Filicum ignored *fuscum* under whatever genus; and Raciborski, Flora v. Buitenzorg, ignored *H. Zollingerianum*. I do not find any character by which any line can be drawn between the two; nor do the several differences between the extremes constitute a cumulative difference, because they are correlated, all alike presumably affected by the same external conditions. I have collected on the Gedeh the extremes, together, even on the same rhizome (Plate 31, fig. 1).

The fronds of typical *H. fuscum* are broadly lanceolate to ovate, 6 to 15 cm long, acute and compact. From this they

vary to narrowly lanceolate with remote pinnæ and attenuate apex, and up to 35 cm long, in which form it is typical *H. Zollingerianum*. I suppose that the elongate, lax form develops in moist, sheltered places.

The rachis is more narrowly winged (it is never very broad) in the elongate form, and on well-developed fronds is always wingless at the base. The upper part of it bears the supplementary wings on the nether side (cf. Blume's *superne*). Partly in continuation of the supplementary wings, the base of the involucre bears several similar longitudinal wings, extending almost as far as the tube.

The species seems to be common in Java, at least West Java, from which I have seen type material of all described species. A considerable part of the more recent collections, correctly placed under *H. fuscum* in the Leyden Herbarium, are typical *H. Zollingerianum*. I have seen a single specimen from Sumatra, *Rosenstock Fil. Sumatra. exsicc. 210, Winkler*. An older Sumatra collection was misidentified; it is a sterile fragment of some other species.

The walls of *H. fuscum*, correctly depicted by van den Bosch taking together his drawings of *H. fuscum* and *H. Zollingerianum*, are thin, straight or slightly wavy in median optical section, nearly straight or minutely wavy where they strike the surface walls, and toothless or somewhat toothed there. The more evident reticulation and toothing of *H. geluense* and *H. laminatum* is indicated, but very slightly developed.

67. HYMENOPHYLLUM LEDERMANNI Brause. Plate 32.

Hymenophyllum Ledermanni Brause, Bot. Jahrb. 55 (1920) 41.

Rhizoma longe repens, 0,8 mm crassum, glabrescens, juventute pilis ferrugineis articulatis densis munitum, folia interstitiis 2–4,5 cm longis emittens. Petioli fusci, teretes, rigidi, superiore in parte angustissime alati, rhizomati similes glabrescentes vel pilosi, 7–13 cm longi, 1 mm crassi. Lamina 10–15 cm longa, 2,5–7 cm lata, sicca fusca, glabra, ambitu lanceolata vel ovata, in apicem obtusiusculum desinens, pinnato-bipinnatifida vel bipinnato-pinnatifida; pinnis I petiolatis, 10–14-jugis, approximatis, alternis, suberecto-patentibus e basi cuneata rhomboideo-oblongis, apice truncatis, usque ad 3 cm longis, 1,7 cm latis; pinnis II e basi cuneata ovatis vel rhomboideis, obliquis, approximatis, apice truncatis, usque ad costulam fere pinnatifidis; segmentis linearibus vel subquadrangularibus, fasciculatim subparallelis, confertis, margine integris; rachibus costisque fuscis, anguste alatis, pilis longis, ferrugineis, articulatis curvatis densis instructis; costis nervisque validis, fusco-pilosis, utrinque lamellis membranaceis praeditis. Sori superiorem dimidiam laminae partem occupantes,

axillares, nervorum ramo infimo antico abbreviato impositi, pinnis II basilaribus interdum 2 sores gerentibus exceptis singuli in pinnis II, usque ad 8 in pinnis I, uniseriales in utroque costae latere, ca. 2,5 mm longi, 1 mm lati, angustissime marginati, indusio cupuliformi, ore vix dilatato, dorso nervis aequali lamellis densis prominentibus armato, bilabiato; labiis apice rotundatis, laevibus (non lamellis praeditis), membranaceis; receptaculo crasso, brunneo, usque ad 0,5 mm exserto.

Nordöstl. Neu-Guinea: Kaiserin-Augusta-Fluss-(Sepik) Gebiet: Etappenberg, dichter Höhenwald, hell grünes Hymenoph., epiphytisch in einer Baumkrone, 850 m ü. M. (Ledermann n. 9408.—21. Okt. 1912),—ebendort, 10–15 cm hohes Hymenoph. im Moospolster der Bäume (Ledermann n. 8993.—3. Okt. 1912).

Gehört zu den Arten, bei denen die Kosta und Nerven mit zweiflügeligen Leisten versehen sind, wie bei *H. fuscum* Bl. und *H. gelnense* Ros. Letzteres ähnelt der vorliegenden Art im Habitus sehr, auch in dem trichomanoiden Indusium, aber es hat gezähnten Blatt- und Leistenrand, weiter auseinander gestellte Nerven und breitere letzte Fiederabschnitte. Bei der vorliegenden Art Bestehn die Fiedern II hauptsächlich aus den durch die Leisten noch dicker erscheinenden Nerven, an deren beiden Seiten die Blattfläche auf das äusserste beschränkt ist.

Die Art scheint in der Form und Länge der Fiedern sehr veränderlich zu sein. Es liegen etwas 35 an derselben Stelle gesammelte Blätter vor, von diesen ist kaum eines dem anderen gleich. Die Fiedern I werden bis 6 cm lang und sind am Scheitel nicht gestutzt, sondern im Gegentiel lang zugespitzt; Fiedern II werden schmäler, zahlreicher und spitzer; letzte Fiederabschnitte noch schmäler. Die äusserste Form dieser Abweichungen möchte ich bezeichnen als:

Var. NUTANS Brause n. var.—Differt laminis nutantibus, pinnis longioribus, longissime acuminatis, pinnis II angustioribus, numerosioribus, acuminatis; laciniis angustioribus.

Nordöstl.-Neu-Guinea: Kaiserin-Augusta-Fluss- (Sepik-) Gebiet: Lordberg, lichter Bergwald, bräunlich-hell-grünes Hymenoph., Behaarung dunkelbraun, in den grossen Moospolstern der Baumkronen, 2000 m ü. M. (LEDERMANN n. 10117.—6. Dez. 1912).—Etappenberg, 850 m ü. M. (LEDERMANN n. 9171a.—11. Okt. 1912).

I am indebted to the courtesy of the Berlin Botanic Garden for a partial frond of the type collection, *Ledermann 9408*. It is nearer to *H. fuscum* than to the related Papuan species, as shown by the entire margins and by the cellular structure. The most of the walls are almost uniformly thin, but crenulate or slightly toothed walls can be detected here and there. The frond is the most compacted in the group, the veins in the uncut central parts of the pinnæ and pinnules running parallel and so close together that the secondary wings are in many places in contact, concealing the normal lamina.

The variety is probably not one, but merely an edaphic form like *H. Zollingerianum*.

47a. HYMENOPHYLLUM CERNUUM Gepp.

Hymenophyllum cernuum GEPP, in Gibbs, Dutch N. W. New Guinea (1917) 68.

I have not seen this plant. By description, it seems to resemble a slender form of *H. Ledermanni*.

48. HYMENOPHYLLUM GELUENSE Rosenstock. Plate 11.

Hymenophyllum geluense ROSENSTOCK, Fedde's Repert. 5 (1908) 372.

Leptocionium; rhizomate longe repente, vix ramoso, 1 mm crasso, rufo pilisque rufis dense obsito, radiculis 2–3 cm longis, creberrimis instructo, interstitiis 5–15-centimetralibus folia gerente; stipitibus 10–20 cm longis, rigidis, teretibus, atrofuscis, pilis fuscidulis 2–3 mm longis, tricatis obtectis; laminis rigide membranaceis, fuscidulis, 20–30 cm longis, nunc linearibus, 2–3 cm latis, nunc lanceolatis, basi usque ad 8 cm dilatata; illis pinnatis, pinnis alternis, numerosissimis, erecto-patentibus, apice incurvatis, anguste decurrentibus, e basi inaequali (anteriore cum rhachi parallela, posteriore oblique truncata) rhomboideo-oblongis, apice truncatis aut elongato-acuminatis, 1½–3 cm longis, 1 cm latis, 2-3-pinnatifidis, laciniis ultimis anguste linearibus, confertis, fasciculatim subparallelis, margine plano acuto serratis, apice attenuato integerrimis (nec emarginatis); his (sc. laminis lanceolatis) bipinnatis, pinnis inferioribus usque ad 10 cm longis, 3–4 cm latis, faciem laminae simpliciter pinnatae omnino interruptibus, ceteris sensim minoribus, subconformibus; rhachibus cum stipitibus concoloribus, elasticis, margine angusto, olivaceo-fusco, plano, integerrimo vel (apicem versus) denticulato pilisque iis stipitum aequalibus instructis; costis nervisque crassis, atrofuscis, fuscopilosis, in utraque facie lamellis binis membranaceis, conspicue cristato-serratis ornatis; soris 1–4 in singulis pinnulis, axillaribus, costularum ramo anteriori, abbreviato impositis; indusiis magnis, late tubiformibus, anguste marginatis, dorso cristatis, bilabiatis; labiis tubum aequantibus, rotundatis, minutissime denticulatis vel integerrimis; receptaculo crasso, setaceo, exserto.

Nova-Guinea, in monte Gelu, c. 1000 m alt.—leg. Dr. E. Werner, VII, 1907, No. 48.—ROSENSTOCK, loc. cit.

I know, and have illustrated, this species by a subsequent collection, *Rosenstock, Fil. novoguin, exsicc. 178, Ramler*, Sattelberg, altitude 900 m. This is represented in the Phil. Nat. Herb., the Gray Herb., and particularly well in the Herb. Univ. Calif. Collectively these illustrate fairly the described range in size and dissection.

The cells are slightly elongate; internal walls broadly and shallowly reticulate-pitted, finely wavy where they impinge against the surface walls and there conspicuously toothed by thickened lines on the superficial walls.

49. HYMENOPHYLLUM LAMINATUM Copeland. Plate 34.

Hymenophyllum laminatum COPELAND, Philip. Journ. Sci. § C 6 (1911) 70.

Rhizomate repente pube purpurea vestito; stipite 4 ad 5 cm alto sursum pubescente; fronde ca. 15 cm alta, 2.5 ad 3.5 cm lata, lanceolata, rhachi angusto 2–4 alata; pinnis lanceolatis, acutis, inferioribus brevistipitatis, fere ad costam pinnatisectis; segmentis oblanceolatis vel obovatis, apice incisis sparse serrulatis, tenuiter rigidis, rufis; venis venulisque late et usque ad marginem undulato-cristatis; soris secus rhachin ordinatis, basi cristatis, ore bifido, laciniis denticulatis.

[King] No. 341, Lakekamu. [Papua.]

Nearest *H. fuscum* (Blume) v. d. Bosch, differing from this relative in the narrower pinae, more prolonged lamellae, occasionally serrate margin and denticulate lobes of the indusium.—COPELAND, loc. cit.

The cells of the normal lamina are somewhat elongate. The internal walls are broadly and shallowly pitted (reticulate), and nearly straight or finely wavy where they meet the superficial walls. Along these lines, there are outgrowths (teeth). The degree of the thickening which forms the pits and teeth is very variable on different parts of the one known specimen.

In publishing this, I overlooked the then recently described *H. geluense*. Judging by the single collections *H. laminatum* seems very well and conveniently distinguished by the much less hairy and more slender stipe and rachis. Also the secondary lamination is more continuous, firmer, and less toothed, and the involucre less cristate.

3. Subgenus MYRIODON novum

Lamina normale continua omnino carente, dentibus longitudinalibus ad rhaches costasque ubique et irregulariter affixis substituto, involucro medio fisso ubique dentifero, receptaculo extruso.

One species, endemic in New Guinea. Apparently a very specialized derivative of *H. denticulatum*.

50. HYMENOPHYLLUM ODONTOPHYLLUM Copeland sp. nov. Plate 35.

Rhizomate 0.3 mm crasso, glabrescente; stipite 1.5 ad 4 mm alto, filiforme, tereto; fronde usque ad 8 cm longa, vix 2 cm lata, bi-tripinnata, pinnis et pinnulis adscendentibus sursum dense imbricatis, rhachibus "costisque" ubique dentibus longitudinalibus heterostiche insertis, basibus elongatis deinde valde attenuatis, apicibus filiformibus saepe fuscescentibus, densissime obsitis, lamina frondis aliter carente; cellulis plerisque elongatis,

parietibus marginalium denticulis incurrentibus ornatis, internalibus rectis vix incrassatis, apud superficiem plerumque inconspicue irregulariter incrassatis; soris supraaxillaribus, sessilibus, involucro ca. 2 mm longo, 1.5 mm lato, ubique densissime dentifero, receptaculo longissime exserto.

NEW GUINEA, "Kaiserin-Augusta-Fluss-(Sepik-) Gebiet: Felsspitze—in Baumkronen," altitude 1,400 to 1,500 m. *Ledermann 13057*. Type in Herb. Univ. Calif.

This is *H. sabinifolium* var. *imbricata* Brause, Engler's Bot. Jahrb. 56 (1920) 45. I have no doubt that *H. sabinifolium* var. *irregularis* Brause, ibidem, is the same. But it is not *H. acanthoides* (*H. sabinifolium*), and I am not sure that they are intimately related. That species has all axes, from stipe to veins, bearing on each side a continuous wing, such as regularly constitutes the lamina in this family, the wing being exceedingly overfull and therefore rufiled (crisped), with the result that the very numerous large marginal teeth stand out in all directions. *Hymenophyllum odontophyllum* bears no continuous wings. Instead, with increasing density from the base of the rachis to the lips of the pinnules, the axes are beset with individual, separate teeth, the few basal ones in the position of a discontinuous but otherwise normal lamina, but elsewhere apparently erect from any line on the periphery of the axes. They are so densely placed, and so imbricate, that the bases become hidden; where they are least dense, I have thought that they might be in six or eight rows. They might represent the supplementary and normal laminæ of *Amphipterum*, but I have no evidence except their place of origin to support this suggestion.

4. Subgenus HEMICYATHEON Domin

Hemicyatheon DOMIN, Bibl. Bot. 20 Heft. 85 (1915) 20.

Pinnulis (segmentis) ultimis integris vel spinuloso-denticulatis; indusiis infundibuliformibus parte inferiore connatis sed supra profunde (usque ad medium vel duas partes tertias) bilabiatis et campanulato-patentibus; receptaculo longe exserto.—DOMIN, loc. cit.

A group of two known species, typified by *H. Baileyanum*, with entire margin. The second species, with serrate margin, is neither *H. praetervisum* nor the Australian plant, *H. pseudotunbridgense*, placed here by Domin, but is *H. Deplanchei*, of New Caledonia. As the chief reason for recognizing this group as an entity is its containing species with both kinds of margin, it is an amusing coincidence that such a pair of species actually exists. Unless the group be recognized as such, either its two

members must be widely separated, contrary to nature, or it must be included in *Meringium*, where *H. Baileyanum* would be very much out of place, or in *Mecodium*, where *H. Deplanchei* would be altogether misplaced.

I have already shown that the occurrence of such a group as this is explicable by assuming hybridization between members of the two great groups the characters of which are here combined.

Key to the species of the subgenus Hemiexathecum.

Margin toothed ..... 32. *H. Deplanchei.*
Margin entire ..... 31. *H. Baileyanum.*

31. HYMENOPHYLLUM BAILEYANUM Domin. Plate 36.

Hymenophyllum Baileyanum DOMIN, Bibl. Bot. 20 Heft 85 (1918) 21, *pl. 2, figs. 2, A.*

H. trichomanoides F. M. Bail. Rep. Gov. Sci. Exped. Bell.-Ker Range 74 (1889), 3rd Suppl. Syn. Queensl. Fl. 90 cum tab. (1890), Catal. Plants Queensl. 58 (1890), Lithogr. Ferns Queensl. tab. 31 (1892), Queensl. Fl. VI. 1946 (1902), non v. d. Bosch 1863.

Rhizomate longissime repente saepe 2 m vel usque 1 m longo tenui filiformi fusco paleis piliformibus adpressis sed apice recurvis sat dense obtecto vel rhizomatibus vetustis interdum subnudis; frondibus sparsis distantibus stipitatis, stipitibus gracilibus nudis exalatis circa 15–20 mm longis; lamina in circuitu ovato-oblonga ovato-lanceolata usque fere lanceolata apice interdum attenuato-elongata circa 5–8 cm longa et 2½–4 cm lata utrinque glabra pellucida; rhachi tenuiter sed conspicue alata, ala circa 3 mm lata plana; lamina bipinnata, pinnis densiusculis planis flabellato-pinnatifidis, pinnulis ultimis valde obtusis linearibus circa 1½–2 mm latis integerrimis; venis dichotomo-flabellatis fuscis prominulis; soris in venulis lateralibus terminalibus in leviore parte superiore sat numerosis segmentorum apice insertis; indusio basi segmento immerso infundibuliformi sed apice libero (indusii totius dimidium vel usque fere duas partes tertias exhibente) bilabiato, labiis late oblongis integris obtusis glabris demum subpatentibus; receptaculo prima juventute incluso demum longe (usque 3 vel interdum quoque 4 mm) exserto.

Endemisch auf dem höchsten Rücken des Bellenden-Ker, auf Bäumen und Sträuchern epiphytisch wachsend (Bailey 1889, Domin l. 1910 auf dem mittleren Gipfel).

Eine sehr merkwürdige Pflanze, die einigermassen zwischen *Trichomanes* und *Hymenophyllum* steht. Schon BAILEY sagt: "Indeed it may be placed in either *Trichomanes* or *Hymenophyllum*; I place it in the latter because the whole of the exserted portion of the indusium consists of the two long obtuse lobes."—DOMIN, loc. cit.

Through the kindness of Mr. C. T. White I have been able to study the ample type collection of this species. Domin's description is excellent. The frond is thin, even for *Hymenophyllum*. The walls are glasslike in transparency, vanishing in too strong light; they are slightly thickened, minutely irregularly thickened

or minutely crenulate (as to the sides, not as to the walls as a whole).

On this species, Domin, op. cit. 20, based a new subgenus, *Hemicyatheon*.

As diagnosed, this would include *H. holochilum* and the difficult group of *H. edentulum*, to which I do not believe that *H. Baileyanum* has any near affinity. It is distinct in texture, nakedness, and wall structure. Neither do I relate it to *H. praetervisum*.

The involucre is of too general a type to be significant. However, aside from *H. macroglossum* and a few relatives with thick, toothed walls, the combination of entire margin, half-cleft involucre, and long receptacle is peculiar enough to justify Domin's subgenus.

33. HYMENOPHYLLUM DEPLANCHEI Mettenius. Plate 16.

Hymenophyllum Deplanchei METTENIUS, Linnaea 35 (1868) 393.

Rhizoma ultra setaceum, palaceo-setosum; folia membranacea, firma, flavo s. olivaceo-viridia, glaberrima, tri-subquadripinnati-partita; petiolus 2" longus e basi cum rhachi anguste alatus; lamina 3½" longa, deltoidea; laciniae primariae approximatae s. imbricatae, patentissimae, brevi petiolulatae trapezio-oblongo-lanceolatae, infimae suboppositae, ovato-lanceolatae, secundariae ala latiore siccitate recurva confluentes, trapezio-oblongae, obtusae, tertiariae late crenatae, bi-trifidae, superiores et ultimae oblongae s. elongato-oblongae, obtusae repande s. obtuse serratae, hinc inde ad latera subintegerrima antice dente una altiore praeditae; sori in dimidio superiore laminae laciniulas anticas infimas s. inferiores paullulum abbreviatas occupantes, basi cuneati immersi; labia indusii tubum aequantia, semi-oblonga, obtusissima, integerrima s. obscure repandula; receptaculum inclusum; paraphyses nullae.

Nova Caledonia; sur les arbres; au pic de la montagne de Mu, 1864 (Deplanche n. 174).

Petiolo anguste alato ab *Hym. multifido* Sw. et *bivalvi* Sw. recedens, sororum numero ac dispositione cum posteriore, indusii magnitudine cum priore congruens, habitu ceterum *Hym. sanguinolento* non absimile.

—METTENIUS, loc. cit.

Rhizome 0.5 to 1.0 mm in diameter, wiry; stipe about equally stout, 5 to 10 cm long, dark, with a narrow green wing nearly to the base; frond 8 to 20 cm long, broadly ovate, acuminate with apex usually curved, clear-green, tri- or quadripinnatifid, axes everywhere winged, the wing toothed where not exceedingly narrow; segments crowded, about 0.8 mm wide with remote, prominent teeth; cells mostly isodiametric, internal walls clear, thin, straight, and even, fringed exactly where they strike the surface walls with close, short, thin, colorless teeth, not every-

where visible; sori numerous, on subobsolete supra-axillary segments, involucre about 2.5 mm long, 1 to 1.5 mm wide, cleft hardly halfway down, tube smooth, winged or not winged at base, lips pale, wide, broadly rounded, usually entire or nearly so, but sometimes distinctly toothed, receptacle usually but not always included.

Endemic in New Caledonia.

Specimens: *Balansa 2706a, Cribs 1343, LeRat 843, 874, Schlechter 14757* (as *H. dimidiatum*), *Franc 68bis, "F", 1394, 2257,* and *Rosenstock Fil. Novae Caled. 132.*

5. Subgenus EUHYMENOPHYLLUM

Hymenophyllum J. E. Smith, Mém. Acad. Turin 6 (1793) 418, genus, typified by *H. tunbridgense*, the only original species.

This subgenus is characterized by small fronds, toothed margins, cell walls little if at all differentiated, involucres cleft to the bottom or nearly so, slender receptacles included or hardly exceeding the lips, and sessile sporangia. It is not a large group, and is distinctly nontropical, reaching the latitudinal extremes of the family, north and south. *Hymenophyllum affine* and *H. perfissum* are the only local tropical species in the Old World, unless *H. boutocense* belongs here, and unless, as has been stated, it is represented in tropical Africa. *Hymenophyllum barbatum* and *H. simonsianum* have a range within the Tropics, but are better regarded as North Temperate Zone plants.

Many species have been described as relatives of *H. tunbridgense*, but the usual feature responsible for this is nothing more conclusive than smallness.

Key to the species of the subgenus Euhymenophyllum.

Axes not scaly.
  Lips of involucre entire or essentially so.
    Frond more than 2 cm long.
      Rachis of well-developed plants wingless at base.
        Sori sessile. (Australia, Norway, etc.) 53. *H. peltatum.*
        Sori slightly immersed. (Fiji.) ..... 54. *H. affine.*
        Sori stalked.
          Segments 1.5 mm wide. (Borneo.) 55. *H. perfissum.*
          Segments 0.5 mm wide. (Australia.) 58. *H. gracilescens.*
      Rachis winged throughout. (Australia.) 56. *H. antarcticum.*
    Frond under 15 mm long. (New Zealand.) .... 57. *H. Cheesemanii.*

Lips of involucre toothed.
Frond more than 2 cm long.
Rachis winged throughout.
Segments 0.5 mm wide. (Australia.)
58. *H. gracilescens.*
Segments 1 mm wide.
Segments serrulate. (South Africa; Europe.)
59. *H. tunbridgense.*
Segments spinulose-dentate. (Asia.)
60. *H. barbatum.*
Segments 2 mm wide. (India to Formosa.)
61. *H. rimosianum.*
Rachis terete toward base.
Marginal teeth falcate. (New Zealand.)
62. *H. revolutum.*
Marginal teeth straight. (Australia.)
63. *H. cupressiforme.*
Frond under 2 cm long.
Involucre shallowly cleft.
Marginal teeth conspicuous. (New Zealand.)
62. *H. revolutum.*
Marginal teeth small. (Australia.).... 64. *H. pumilum.*
Involucre deeply cleft. (New Caledonia.) 65. *H. pumilio.*
Axes scaly and hairy. (Sikkim, Himalaya.). ... . 66. *H. Levingii.*

H. HYMENOPHYLLUM PELTATUM Desvaux. Plate 17.

Hymenophyllum peltatum DESVAUX, Prod. (1827) 333.
Trichomanes peltatum POIRET, in Lam., Encyc. 8 (1808) 76.
Hymenophyllum unilaterale WILLDENOW, Sp. Pl. 5 (1810) 521.
Hymenophyllum Wilsoni HOOKER, Brit. Fl. 1 (1830) 446; WILSON, Suppl. to Engl. Bot. pl. 2686.
Hymenophyllum Meyeri PRESL, Hymen. (1843) 142.
Hymenophyllum tunbridgense SCHKUHR, Krypt. Gew. *pl. 125. d*, non Smith.

The descriptions by Poiret and Willdenow were both based on a collection by Bory in Bourbon, and Poiret's is so poor that I present Willdenow's.

H. frondibus pinnatis, pinnis digitato-pinnatifidis secundis, lacinis linearibus subbifidis serratis, soris supraaxillaribus solitariis, indusiis integerrimis, rachi stipiteque teretibus glabris. W.

H. frondibus pinnatis linearibus, pinnulis cuneiformibus dentatis, interne laciniatis et soriferis. Bory in litt.

Einseitiger Hautfarrn. W.

Habitat in insulae Borboniae montibus mille orgyas supra mare elevatis, ad rupes humidas. 4 (v. s.)

Caudex repens filiformis crassitie capilli. Stipes pollicaris capillaris teres glaber. Frons sesqui- vel bipollicaris pinnata, circumscriptione lineari-lanceolata. Pinnae inferiores et superiores minores intermediae trivel quadrilineares digitato-pinnatifidae glabrae secundae. Laciniae lineares

indivisae vel bifidae obtusiusculae serratae. Rachis teres glabra. Sori supraxillares sessiles. Indusia oblonga obtusa integerrima. W.
—Willdenow, loc. cit.

The range is from Norway to France and Ireland, and around the globe in the South Temperate Zone.

It is nearly related to *H. tunbridgense*, from which it is critically distinguished by the entire lips of the involucre. In the British Isles, whence there are many specimens of both, this one has usually longer, narrower, and laxer fronds, longer and narrower segments, the wing of the rachis narrower or obsolete toward the base, and narrower involucre. It is so nearly the same in all parts of its range that there is little temptation to recognize local derived species.

The cell walls are uniformly thin, and the cylindrical receptacle is, at least usually, included.

45. HYMENOPHYLLUM THOMASSETII C. H. Wright.

Hymenophyllum Thomassetii, C. H. Wright, Kew Bull. (1906) 170.

Rhizoma repens, gracile. *Stipes* erectus, gracilis, glaber, circa 1 cm. longus. *Lamina* bipinnatisecta, 5 cm. longa, 2.5 cm. lata, glabra; segmenta linearia, 0.7 mm. lata, praesertim versus apices minutissime serrata; rhachis anguste alata. *Sori* quasi-axillares ad rhachin; involucrum breviter ovatum, integrum vel minutissime dentatum.

British Central Africa. Mount Mlanji, 2400 m., *Thomasset*.

Said to differ from *H. tunbridgense* in form of segments and in subentire involucres. As to both of these criteria, it might be *H. peltatum*, but I do not care to reduce it without seeing a specimen.

46. HYMENOPHYLLUM AFFINE Brackenridge. Plate 38.

Hymenophyllum affine Brackenridge, U. S. Expl. Exped. 16 (1854) 265, *pl. 37, fig. 1, a, b, c*; van den Bosch, Ned. Kruid. Arch. 5 (1863) 171.

Hymenophyllum tunbridgense var. *exsertum* Bailey, Rep. Exp. Belenden-Ker (1889) 74; Fifth. Queensland Ferns, *pl. 90*.

Hymenophyllum praetervisum var. *australiense* Domin, Bibl. Bot. 20 Heft 85 (1913) 21.

Hymenophyllum pseudotunbridgense Watts, Proc. Linn. Soc. New South Wales 39 (1915) 766.

H. rhizomate filiforme repente; stipitibus brevibus tenuibus parce villosis; frondibus parvis membranaceis late ovatis bipinnatifidis; pinnis imbricato-confertis subflabellatis, laciniis lineari-oblongis obtusis simplicibus vel bifidis spinuloso-serratis; indusio supra-axillari obovato basi subimmerso infra medium usque bivalvi, labiis integerrimis; receptaculo brevi incluso.

Hab. Ovolau, Feejee Islands: on rocks.

Rootstock long, *filiform*, and creeping. *Stipes* about half an inch in length, very *slender*, *terete*, *sparingly villous*. *Fronds bipinnatifid*, from

half an inch in length, *membranaceous, broad-ovate* or ovate in circumscription, with *imbricated and somewhat subflabelliform pinnae*; the *laciniae linear-oblong, obtuse* and *simple*, or oblong and *bifid*, the margin *spinulose-serrate*. Sori few on the upper half of the fronds; the *indusium supra-axillary, obovate*, plane, and *two-valved* for fully two-thirds of its length, the margin of the *lips entire*, the base only *slightly immersed* in a short segment. *Receptacle short included*.

This is related to the *H. Tunbridgense;* from which it is distinguished by the shorter stipe, the broader fronds, the crowded and imbricated pinnae and particularly by its obovate, deeply divided, entire-lipped indusium.

In the latter respect it resembles more the *H. Wilsoni*, but the indusium is not inflated at the base as in that species; the form of the fronds and direction of the pinnae are also very different.—BRACKENRIDGE, loc. cit.

The type in the United States National Herbarium is as described, with very small fronds cut nowhere to the rachis. *Parks 20040*, collected from the trunk of mangrove trees in Suva Harbor, matches the type with its smaller fronds, but has others 3 cm long and narrower in outline, which are completely pinnate at the base, with terete rachis above the lowest pinnae.

Instead of a "species caeterum egregie distincta" (van den Bosch), it seems to me to be rather a local derivative of *H. antarcticum* or its group (*H. peltatum*), with rather broader segments and some pubescence on the axes.

Known to me by the two collections already cited in Fiji, and by two in Queensland, one the type collection of *H. tunbridgense* var. *exsertum*. A plant distributed with this name from Pahang (*13933*—probably a Singapore field number) is *H. edentulum*, or near it.

56. HYMENOPHYLLUM PERFISSUM Copeland. Plate 33.

Hymenophyllum perfissum COPELAND, Philip. Journ. Sci. § C 12 (1917) 47.

Leptocionium lamina plana, involucro fere ad basin fisso labiis integris; rhizomate filiforme, fusco-nigro, ramoso, nudo; stipite 10 ad 15 mm lato, glabro, filiforme; fronde ca. 4 cm alta, 10 ad 15 mm lata, glabra, pinnata, rhachi sursum anguste alata ala integra, deorsum vix marginata; pinnis majoribus subpinnatifidis segmentis 3 ad 5, minoribus furcatis, minimis simplicibus, segmentis ca. 4 mm longis, vix 1.5 mm latis, obtusis, serratis dentibus paucis subspiniformibus, fuscis vel fusco-olivaceis; soris segmenta abbreviata prima acroscopica pinnarum subapicalium occupantibus, receptaculo fusiforme incluso, involucro ⅔ ad basin fisso, labiis obovato-orbicularibus, integris, nudis, 1.5 mm longis.

BORNEO, Mount Kinabalu, altitude 3,700 meters, on tree trunks, *Mrs. Clemens 10588*.

Apparently a quite distinct little plant.—COPELAND, loc. cit.

Still known by the type collection only.

The only addition to the description is that the walls are uniformly thin.

Very distinct in its own area, but very close to *H. peltatum*, from which it is feebly distinguished by broader segments, and in general by narrower wings on the rachis.

54. HYMENOPHYLLUM ANTARCTICUM Presl. Plate 49.

Hymenophyllum antarcticum Presl, Hymen. (1843) 142.
Hymenophyllum Babindae Watts, Proc. Linn. Soc. New South Wales 39 (1915) 766, *pl. 87, fig. 5.*

H. glaberrimum, fronde oblonga obtusa bipinnata, pinnis subsessilibus oblongo-lanceolatis, pinnulis oblongo-lanceolatis obtusis sinuato-acuteque serrulatis decurrentibus, soris pedicellatis obovato-subglobosis, indusio integerrimo aut obsolete denticulato receptaculum aequante, stipite rachibusque alatis.

H. tunbridgense. Sieb. *syn. fil. n.* 134, *flora mixta n.* 254.

Habitat in Nova Hollandia ad Port Jackson, ubi legit Sieber.

Prioti [*H. Meyeri*] et H. Wilsoni affine; ab H. Meyeri differt pinnis utrinque evolutis, pinnulis latioribus oblongo-subinde obovato-lanceolatis, rachibus stipiteque alatis, soris pedicellatis, indusio obovato-subgloboso, receptaculo indusii longitudine aut longiore.—Ab H. Wilsoni differt praecipue pinnis pinnulisque, soris, indusio et receptaculo.—Presl, loc. cit.

A cotype, *Sieber. Syn. Fil. 134*, is *Herb. Lugd.-Bat. 908, 282-208*, and I have used it to illustrate this species, which has usually been construed as *H. tunbridgense*. With it I identify collections by Boorman from Beronera and Bateman's Bay, and by Gunn from Tasmania, ex Herb. Hooker as *H. unilaterale* and *H. tunbridgense*.

The rachis is narrowly winged throughout; the walls uniformly thin; the involucres very broad with crenate or obscurely toothed lips; the receptacle slightly extruded in many sori, not so in others.

I do not believe that this should be reduced to *H. tunbridgense*, but do suspect that, with any such number of collections as represent the commoner Malayan species, this might become inseparable from *H. cupressiforme*.

A cotype of *H. Babindae*, sent me by Mr. White from the Queensland Herbarium, seems to me to be a dwarf form of *H. antarcticum*, the fronds hardly 2 cm long.

57. HYMENOPHYLLUM CHEESEMANNI Baker. Plate 41.

Hymenophyllum Cheesemanni(rite, Cheesemanii) Baker, in Hooker's Ic. III 2 (1873) 50, *pl. 1132*, Syn. Fil. (1874) 464.

Rhizomate nudo filiformi, stipitibus brevissimis filiformibus nudis, frondibus minimis dichotome furcatis vel palmatim 3–4-fidis raro simplicibus, lobis ligulatis obtusis ciliato-dentatis, venis in segmentis solitariis centralibus, soris solitariis terminalibus, involucri valvis rotundatis integris basi solum immersis.

Hab. New Zealand; Titiranga range, at an elevation of 1,200 feet, discovered by Mr. T. F. Cheeseemann in 1871.

Rhizomata late vagantia intricata. *Stipites* segregati, erecti, 3–6 lin. longi, glabri, haud paleacei. *Lamina* viridis, membranacea, glabra, max brunnescens, 3–6 lin. longa, basi in stipitem angustata, lobis 3–5 lin. latis ligulatis simplicibus, lateralibus erecto-patentibus. *Dentes* marginales lineari-subulatae, ascendentes, demum caducae, cellulae magnae irregulariter hexagonae marginales reliquis conformae, parenchymatosae. *Involucrum* vix lineam longum, semper ad apicem frondis vel segmentorum solitarium, terminale, valvis duris brunneis integerrimis lineato-marginatis dorso nudis laevibus.

A very distinct novelty, nearest *H. minimum*, A. Rich, 'Voy. Astrolabe,' t. 14, fig. 2; but differing essentially in the involucre, and in the cutting of the frond, in which it much resembles some of the forms of Trichomanes digitatum.—BAKER, in Hooker's Icones.

The United States National Herbarium contains a specimen collected by Cheeseman at Titirangi, near Auckland, likely to be a cotype, and at any rate authentic; also a sterile specimen from the Waitakerei ranges, without further data. The majority of the fronds are bifid or simple. If the segments are three or four, the central one is elongate. This would suggest a pinnatifid ancestry, but I still ascribe the species to *Microtrichomanes*.

A few fronds exceed 1 cm in length, but the majority are smaller, decurrent on the short stipe; segments rather more than 1 mm wide; teeth with a pluricellular base bearing a straight filament about four cells long; cell walls slightly thickened, porepitted, hyaline, straight; involucre acute at base and winged there, cleft scarcely to the wing, the valves broadly rounded, dark and firm, apparently entire. I have found but one sorus and have not ventured to dissect it.

Both Cheeseman and Holloway, Trans. N. Z. Inst. 54 (1923) 592, pl. 67, reduce this species to *H. Armstrongii*, on the ground that the dark margin, once supposed to distinguish the latter, is not a stable character. The testimony of local botanists, especially of one so particularly familiar with these plants as Doctor Holloway, is usually to be accepted; however, the few specimens I have seen seemed to differ in other respects as well as in the border. Whether they be one species or two, they are very reduced, and their affinity is thereby obscured. I list one under *Euhymenophyllum* and one under *Meringium*, noting in both cases that I suspect the plant of being *Microtrichomanes*.

New Zealand, endemic.

58. HYMENOPHYLLUM GRACILESCENS Domin.

Hymenophyllum gracilescens Domin in Bibl. Bot. 20 Heft 85 (1913) 23, *pl. 1, figs. 2–3.*

Gracile, rhizomate filiformi pertenui nudo repente sed nodoso, frondibus numerosis stipitatis; stipitibus filiformibus glabris exalatis fuscis circa 1½ cm longis; frondibus erectis oblongo-ellipticis circa 4–5 cm (raro usque plus 6 cm) longis et 2–2½ cm latis pinnatis; rhachi tenui glabra exalata i. e. tantum apice angustissime alata; pinnis laxis distantibus infimis 2- vel 3 furcatis brevioribus, mediis longissimis pinnatifurcatis lacinulis 3–5 instructis, superioribus bifurcatis, supremis simplicibus, segmentis, lacinulisque omnibus anguste linearibus vix 0.5 mm latis patentibus conspicue serrato-denticulatis, segmentis pluribus parte superiore ad venas angustissime alatas reductis et soros terminales gerentibus; indusio usque ad basin diviso, valvis laevibus circa 1½ mm longis ovatis praecipue supradenticulatis.

N. E.-Queensl.: Bellenden-Ker, zwischen 100–150 m (Domin XII. 1909).

Eine sehr charakteristische Art, schon habituell durch die lockeren, schmal-linealen, einfachen Blattsegmente sehr auffallend und von *H. tunbridgense* hinreichend verschieden.

Mr. C. T. White has lent me collections by *Watts* and by *Waller* supposed to represent this species, neither fitting the description perfectly. To the naked eye, the *Waller* collection, a single frond, is a perfect fit, except possibly as to the shape of the involucre, which is nearly round; but the marginal teeth are more attenuate, and the lip is broadly rounded, and entire or slightly denticulate, while Domin's figure shows it rather as pointed and sharply toothed. The laxness of the frond, the narrowness of the segments, and the long-stalked sori replacing plural segments, all distinguish it well from any other species. Whether or not it is a species distinct from *H. gracilescens*, differing most notably in the margin of the lip, may not well be decided from a single frond.

Endemic in Queensland.

59. HYMENOPHYLLUM TUNBRIDGENSE (L.) Smith. Plate 42.

Hymenophyllum tunbridgense (L.) Smith, in Sowerby, Engl. Bot. (1794) pl. 162.

Trichomanes tunbridgense Linnæus, Sp. Pl. 2 (1753) 1098.

Hymenophyllum dregeanum Presl, Hymen. (1843) 144.

Frondibus pinnatis; pinnis lobatis oblongis crenulatis.

Adianthum petraeum perpusillum anglicum, foliis bifidis trifidisque. *Raj. angl.* 3. p. 123. *Suppl.* 77.

Adianthum radicosum humisparsum s. Filicula pellucida nostras, coriandrifoliis molliculis, globuliferum. Pluk. *alm.* 10. *t.* 3, *f.* 5. 6.

Darea tunbridgensis minor, *Pet. mus.* 761.

Muscus montanus italicus, adianti foliis. *Bocc. mus.* 2. p. 24. t. 2, f. 1. *Habitat* in Anglia, Italia.—LINNÆUS, loc. cit.

Rhizome and stipes finely filiform, glabrescent, stipes 1 to 3 cm long; fronds 2 to 5 cm long, ovate or narrower, tripinnatifid; rachis winged throughout; segments less than 1 mm wide, aculeate-serrate, with very few teeth except near the apices; cell walls thin, the internal ones obscurely pitted in British specimens; sori mostly on the very short lowest acropetal segments of the pinnæ, involucre cuneate and winged at the base, cleft to the wing, with broad valves, the lips regularly or irregularly sharply toothed, receptacle cylindric, included.

Scotland to Italy, the Azores and Madeira, the fronds larger and more lax in the warmer lands.

Hymenophyllum dregeanum of South Africa and Madagascar has still thinner walls, and the lips appear usually to be less, and less acutely, toothed—that is, obscurely toothed to crenate. A very lax form, given a varietal MS name by van den Bosch, has the lower part of the rachis terete. Taken with the geographic discontinuity, this sanctions the specific recognition of *H. dregeanum*, if one so please. However, I find some younger or better-preserved sori on Natal specimens with lips quite like those on topotypic *H. tunbridgense*, making it appear that, if they are held distinct, it must be chiefly on the basis of geographic distribution.

89. HYMENOPHYLLUM BARBATUM (van den Bosch) Baker. Plate 43.

Hymenophyllum barbatum (van den Bosch) BAKER, Syn. Fil. (1874) 68; NAKAI, Bot. Mag. Tokyo 40 (1926) 240.

Leptocionium barbatum VAN DEN BOSCH, Ned. Kruid. Arch. 5[1] (1863) 146.

Leptocionium flaccidum VAN DEN BOSCH, Ned. Kruid. Arch. 5[1] (1863) 149.

Hymenophyllum flaccidum BAKER, Syn. Fil. (1868) 451, *non* van den Bosch (1859).

Hymenophyllum Khasianum BAKER, Syn. Fil. (1874) 464.

Hymenophyllum japonicum MIQUEL, Ann. Mus. Bot. Lugd.-Bat. 3 (1867) 183.

Hymenophyllum Henryi BAKER, Journ. of Bot. 27 (1889) 176.

Hymenophyllum oxyodon BAKER, Journ. of Bot. 28 (1890) 262.

Hymenophyllum fastigiosum CHRIST, Bull. Boiss. 7 (1899) 3.

Hymenophyllum omeiense CHRIST, Bull. Soc. Geog. Bot. 15 (1906) 191: cf. CHRISTENSEN, Acta Hort. Gothob. 1 (1924) 50, Cont. U. S. Nat. Herb. 26 (1931) 272.

Fronde ovata bipinnatifida, laciniis primariis patulis et divergentibus contiguis rhomboideo-ovatis (subcontiguis sinubus brevibus interstinctis 1–2 dichotomis simplicibusve, lacinulis latiusculis albrevitis late undulatis.

margine minute et inaequaliter denticulato, apice rotundato truncato, rhachi flexuosis latissime alatis, venulis angulo patente earumque ramis 1–2 forcipatis simplicibusve angulo rotundato exeuntibus, cunctis nigrescentibus piliisque fuscis rectis rigidis opacis articulatis vestitis, cellulis teneris parum diaphanis mediocribus parvisque leviter elongato-hexagonis acutangulis, parietibus rufescenti-hyalinis teneris subtilissime crenulatis, *interanois* sive parietalibus, spatium amplum hyalinum relinquentibus, sive diffusis amorphis dilutis e rubro fusciduli, soris in laciniis secundariis apicalibus parumper abbreviatis terminalibus immersis parvis ovatis, indusio fundo conico extus piloso late alato, ad medium fere usque bilabiato, labiis margine inaequaliter denticulato-serratis, stipite filiformi terete vel apice angustissime alato 1–2 cent. longo. Rhizoma setaceum horizontale ramosum intricatum glabrescens, frons 3–4½ cent. longa, 1½–2 lata membranaceae diaphana flaccidiuscula ex olivaceo rubro-fusca.

Hab. Ins. Tsou-Sima, WILFORD [Wilford] (Hb. Hook.).

—VAN DEN BOSCH, op. cit. 146.

The reduction of *H. japonicum* was made by Nakai, by comparison of the types in the Herbarium Lugduno-Batavum, and I verify it by the same test. The reduction of *H. Henryi* and *H. omeiense* is by Christensen, is verified as to the former, and is accepted as to the latter. Christensen (op. cit. 272) has also observed that *H. khasianum* "very likely represents a larger tropical form" of *H. barbatum;* the frond length given by van den Bosch is 3 to 4.5 cm for the latter, 4 to 4.5 cm for the former. The smaller specimens commoner in herbaria as *H. barbatum* should have been called *H. japonicum* by those who maintained that species.

Rhizome filiform, hairy but glabrescent, black or dark, intricate and, with the fronds, mat-forming; stipe wiry, dark, glabrescent, 1 to 4 cm long, usually much shorter than the frond; frond 2 to 8 cm long, ovate to round and to broadly lanceolate, bi- or tripinnatifid, base usually broad and apex rounded, rachis with a wing decurrent onto the stipe, usually plane but sometimes wavy or even crisped, axes hairy at first, finally sparsely so or naked; pinnæ crowded, imbricate, or subremote; veins forking at a wide angle and therefore zigzag, very prominent, brown to black; segments commonly 1 mm wide, sometimes wider, separated by rounded sinuses, usually so shallowly that the axis of the pinnæ (and pinnules) are more broadly laminate than the rachis and segments (as in *H. exsertum*), margin variously denticulate or serrulate; walls varying from irregularly slightly thickened and wavy or crenulate (in Japan) to much thickened and coarsely pitted, with the disappearance of waviness (in warm lands); sori usually not abundant, and axial or subterminal, rarely abundant and then usually crowded near

the apex, involucre cleft to the base, back naked (or with a few hairs), lips dentate with attenuate teeth, receptacle included.

I have in hand the types or specimens of the type collections of *H. barbatum*, *H. khasianum* (*L. flaccidum*), *H. japonicum*, *H. Henryi*, and *H. oxyodon*, and therefore reduce them with adequate knowledge of what they are, whether or not the reductions are accepted.

As originally described, *L. flaccidum* was best distinguished by peculiar form of sorus, only one being seen; beyond this, its rachis had a wavy wing and the veins forked at an acute angle. I find none of these criteria either constant or peculiar.

Hymenophyllum japonicum is a small form, with veins said to branch at an acute angle. The size—1 inch or less long—is commoner in herbaria than the typical one of *H. barbatum*, but there is no line between them, in Japan, or Yunnan whence we have most specimens, nor probably anywhere else. As to the angle of branching, Plate 43, fig. 1, represents a frond of the type; the branches seem to me to stand at a rather wide angle. The most distinct form is that aptly named *H. oxyodon*, with widely divergent attenuate teeth, described from Tonkin, said also to be glabrous; "glabrescent" would be correct—the type collection is not quite hairless. I reduce it because it ranges at least to Kiangsi, *Steward 4673*, overlapping and intergrading with more typical plants all the way, and because in Tonkin too more typical forms occur.

Besides these salient teeth, there are two other peculiarities more or less peculiar to the southern and western part of the range of the species: Thickness of walls, and waviness or crispiness of wings and segments. Within the species, no line can be drawn between one type of wall and another, and a considerable part of the variation within the species as here construed is often present on different parts of a single frond. It is true, though, that, from southern China, south and west, the walls are more thickened, and therewith less wavy or crenulate than in Japan.

As to planeness of frond, it is not always plane in Japan, and sometimes is plane in Yunnan and Tonkin. However, real crispiness is commoner and more extreme in the south and west. The most crisped specimen I include here is an unnumbered collection by G. Mann, from the Jainta Hills, altitude 3,500 feet, April, 1889, distributed as *H. Neesii*. Several collections from Tonkin are somewhat crisped, making me suspect that *H. Poilanei* is only an extreme case.

Hymenophyllum fastigiosum is represented in U. S. Nat. Herb. by *Hancock 206*, from the type locality, with Christensen's identification, "t. sp. orig. Henry 11859;" also, by *Pételot 4065*, from Chapa, Tonkin, probably identified by Christensen. Neither is really naked or very nearly so. The walls are exactly those of *H. barbatum* of the same region—the old ones much but irregularly thickened and pitted, those of younger parts of the same frond less thickened, with more evident wavings. The sole difference from *H. barbatum* is in size, and this difference, as to specimens seen, is inconsiderable, a maximum frond length of 9 cm, as against 8 cm in a specimen from Japan.

Specimens: JAPAN, *Wilford 846* (type), *Keiske* (type of *H. japonicum*), *Buerger, Textor, Watanabe, Coville, Holbrook, Sakurai, Tanaka 123, Faurie 4697, 5259*. FORMOSA, without data. KOREA, *Taquet 3636*. CHINA, *Henry 5457* (type coll. of *H. Henryi*), *Ching 2127, 8611, Steward 4678, Wilson 24, Matthew 12, Chung 3583, Merrill 10183, 10980, Hancock 139, 206, Rock 7186a*. INDIA, *Hooker and Thomson* (type fragment of *L. flaccidum*, and another sheet), *G. Mann*. TONKIN, *Balansa 1905* (type coll. of *H. oxyodon*), *Pételot 577, 3333, 3340, 3342, 3601, 3602, 4355*. BURMA, *Rock 7442, 7445a*.

The affinities of this species seem to me literally to be tangled. It is *Hymenophyllum* in the strictest sense; that is, not too remotely related to *H. tunbridgense*. We have long been used to regarding the species with entire margin and those with toothed margin as forming two distinct series, and confining ourselves strictly to its own series in discussing the affinities of any species. Contrary to this practice, I suspect that *H. Reinwardtii* is related rather to species with entire margin; but it is not a typically serrate species. I have the belief, rather than the suspicion, that *H. barbatum* also has relatives with entire margin. The limited resemblance of *"H. japonicum"* and *H. Wrightii* is perhaps the consequence of common environment, but I believe that there is some measure of genetic affinity to *H. exsertum*, much closer than the remote ancestral connection of the entire and the toothed groups as a whole.

66a. HYMENOPHYLLUM POILANEI Tardieu and Christensen.

Hymenophyllum Poilanei TARDIEU and CHRISTENSEN, Bull. du Muséum 6 (1934) 289.

Leptocionium parvum, L. acanthoidi v. d. B. (Hym. Jav. pl. 32) divisione crispatasque fronde valde simile, sed minori et rachi pilosa, indusiis dorso non vel inconspicue spiniliferis diversum. Fronde deltoideo-ovata, stipite nigro, exaltato, 1–2 cm. longo; lamina 1–4 cm. longa, 0.5–2 cm.

lata, bi-tripinnatifida undulato-crispata, lobis ultimis spinescenti-dentatis, rachi crispato-alata, subtus pilis ferrugineis sparse onusta. Soris medium divisis margine exteriore lato profunde dentatis, dorso non vel inconspicue spiniliferis.

Annam: Massif du Hon Ba, août 1913, Vincens, sans n°.- Nhatrang, 1.600 m., mai 1922, Poilane, n° 3,478 (p.p.) et 3.704 (type in Herb. Mus. Paris).

Se rapproche de l'*H. Khasianum* Bak. par sa forme, sa texture, la présence des nombreux poils ferrugineux sur le rachis, et ses segments spinuleux. En diffère par sa plus petite taille, son rachis a aile tres ondulée, ses segments extrêmement crispés, ses sores localisés à la partie supérieure. Il diffère des espèces malaises crispées, *H. Neesi, H. aculeatum*, par son rachis poilu.—TARDIEU AND CHRISTENSEN, loc. cit.

I have not seen a specimen. I have identified other Tonkin specimens with more or less crisped wing and segments as *A. barbatum*, and suspect that I would do the same with this. It is noted that Christ described his *H. fastigiosum* (which I regard as merely a large *H. barbatum*) as either plane or crisped.

81. HYMENOPHYLLUM SIMONSIANUM Hooker. Plate 44.

Hymenophyllum simonsianum HOOKER, 2d Cent. (1860) pl. 13; HAYATA, Ic. Formos. 5 (1915) 258, *fig. 92*.

Didymoglossum simonsianum VAN DEN BOSCH, Ned. Kruid. Arch. 5³ (1863) 145.

Caudice filiformi gracili longe repente, frondibus solitariis distantibus oblongo-lanceolatis membranaceis laxis fuscis bipinnatifidis in stipitem brevem gracilem basi attenuatis apice obtusis, lobis primariis semiuncialibus oblique cuneatis sub lente argute serratis margine inferiore truncatis integris superiore cum apice lobato-pinnatifidis, lobulis paucis (3–5) obtusissimis, involucris in lobis terminalibus frondis ovalibus subobovatisque exsertis profunde bivalvibus, valvis convexis subspinuloso-serratis, venis apice clavatis, soris inclusis receptaculum tegentibus.

Hab. Khasya Hills, Eastern Bengal, *Simons*.

This does not appear to be anywhere described, though it must be confessed, that in so extensive a natural genus, it is very difficult, and in a few words, to define the character of any particular kind. Accurate figures are most to be depended upon.—HOOKER, loc. cit.

Van den Bosch's only published comment is "Species pulcherrima et distinctissima." His unpublished notes place the plant more correctly, as *Leptocionium*, and contain an expression I find nowhere else in his manuscripts, "parietibus . . . aegre distinguendis."

Stipe 2 to 4 cm long, wiry, dark; frond 4 to 7 cm long, about 2 cm wide (the notes of van den Bosch, probably based on study of the type, say stipe 3 to 6 cm, frond 8 to 11 cm by 1.5 to 2 cm wide), rachis winged throughout, it and the veins hairy at first but glabrescent; pinnæ few, short, broad, the lower with 2 to 4

segments 3 to 5 mm long, 3 mm wide, rounded, with comparatively small and rather fragile teeth; walls in all specimens at first very thin and in part permanently so, straight as a whole but finely wavy in detail, presently most irregularly thickened, not quite perpendicular to the surface and therefore obscured by the dense, closely applied cell contents and usually appearing as an irregular chain of clear spots or irregularly placed short streaks; sori terminal on segments 1 to 1.5 mm wide, winged at base only, involucre 2 mm wide and long, cleft nearly to the base, lips rounded, sharply dentate, receptacle cylindrical, included.

Described from Khasia. All Indian specimens seen are from Sikkim or near it: *Hooker* in Gray Herb., *Henderson* in U. S. Nat. Herb., and collector not stated in Gray Herb. and Herb. Lugd.-Bat. from Darjeeling, Kew dist. *128*. Formosa, Arisan, *Faurie 624, Hayata*.

Related to *H. barbatum*, but a thoroughly distinct species. There is a suggestion of *H. edentulum* in the structure of the walls.

41. HYMENOPHYLLUM REVOLUTUM Colenso.

Hymenophyllum revolutum COLENSO, Tasm. Journ. 2 (1844) 186.
Hymenophyllum zeelandicum VAN DEN BOSCH, Ned. Kruid. Arch. 5' (1863) 175.
Hymenophyllum pusillum COLENSO, Trans. New Zealand Inst. 12 (1880) 365.
? *Hymenophyllum pygmaeum* COLENSO, Trans. New Zealand Inst. 13 (1881) 376.
Hymenophyllum tunbridgense C. Chr. *part.*, Cheeseman, HOLLOWAY, Trans. N. Z. Inst. 54 (1923) 592, *pl. 63, vix* Smith.

Plant, small, climbing, few fronded, sub-erect and spreading, glabrous, epiphytical. *Frond*, ovate or oblong-lanceolate, obtuse, pinnate-pinnatifid or sub-bipinnate, 2-5 inches; dusky green. Pinnules; somewhat trapezio-falcate, petiolate, alternate, distant, pinnatifid, 3–12 lobed; *Lobes* linear-oblong, truncate, deeply serrate or sublaciniate; serratures acute and somewhat hooked; mostly four laciniations at apex, decurrent, revolute; lowermost wedge-shaped and deeply bifid. *Involucre*, obovate or sub-rotund, inflated, laciniated, supraaxillary, solitary, pedicelled; pedicel, margined: *Valves*, large, open: *Receptacle*, exserted. *Rachis*, flexuose, margined towards apex; margin, serrate; serratures, distant. *Stipe*, filiform, cylindrical, brittle, finely striated, tortuous, 1–1½ inches long. *Caudex*, creeping.

Hab. On sides of prostrate and reclining trees, shores of Waikare Lake; December, 1841.

Obs. A species possessing very close affinity with *H. Tunbridgense, Sm.*—COLENSO, Tasm. Journ. 2: 186.

All of the "species" treated here have been reduced to *H. tunbridgense* (or *H. peltatum*, in error), which I do not find

present from New Zealand. For one thing, all New Zealand specimens have the rachis largely wingless.

Specimens in hand are *Hooker, Brackenridge* (type collection of *H. zeelandicum*), *Kirk 227, 565, 570, Cheeseman, Ranft 7, Holloway, Setchell.*

None of these has a frond 5 inches long, the range being from 8 cm, exclusive of stipe, down to less than 2 cm (fertile). The receptacle is somewhat extruded, or equals the valves, or is shorter; I am quite sure that in this case the difference is not diagnostic. In poorly fruiting material the sori are axillary, as in *H. tunbridgense*, but on contracted segments. In fuller fructification the sori tend to become terminal.

This is as I see it. But I know well that the man in the field can know his plants better than the man in the herbarium, and on that ground would mistrust my judgment in reducing Colenso's three species to two or one, except that the reduction is accepted by Holloway. However, dwarfs in general are derived from plants of more usual size. The two being surely nearly related, *H. pusillum* would probably be derived from *H. revolutum*, and could hardly become specifically fixed in the actual presence of the ancestral form; and they have the same type locality—Lake Waikare. If they are distinct, the name of the smaller form is *H. zeelandicum*.

I have no specimen fitting the description of *H. pygmaeum*, which is very like that of *H. minimum*. Colenso, however, was very positive that they are distinct and not nearly related.

Qualifying the statement that I do not recognize *H. tunbridgense* in New Zealand, a specimen collected by *Setchell* near Wairakei May 9, 1904, and determined by Cheeseman as *H. multifidum*, should be noted. The fertile fronds are 1.5 to 2.5 cm long, bipinnatifid. The rachis, carefully examined, is marginate to the base, which would make it *H. tunbridgense*. The wing is so inconspicuous that, in New Zealand, I prefer to call it *H. revolutum*. Larger fronds in the same collection (4 to 5 cm long) are dwarfed *H. multifidum*, with entire lips and toothed wing. Cheeseman's identification may be correct as to the whole collection. The disappearance of teeth on the obsolescent wing of extreme dwarfs might be expected. But I have seen no other *H. multifidum* with regularly dentate lips or with segments as broad as those of these dwarfs.

63. HYMENOPHYLLUM CUPRESSIFORME La Billardière.

Hymenophyllum cupressiforme LA BILLARDIÈRE, Nov. Holl. Pl. Sp. 2 (1806) 102, *pl. 250, fig. 2*; WILLDENOW, Sp. Pl. 5 (1810) 522.

Hymenophyllum frondibus pinnatis, oblongis; soris supraaxillaribus, solitariis; indusiis ut pinnae subbipinnatifidae serratis.

Filix palmaris, surculo repente, ferrugineo-tomentoso ut radiculae aut nudo. Frons pinnata, oblonga, subfusca, pinnis alternis, patentibus, pinnatifidis, serratis, unguiculatis, lacinius oblongis, simplicibus aut bipartitis; stipite brevi, filiformi. Sori oblongi, supraaxillares, solitarii; columnula frondifera subclavata, inclusa; indusiis obovatis, bivalvibus, serratis. Alias ut in specie praecedenti.

Habitat in capite Van-Diemen.—LA BILLARDIÈRE, loc. cit.

Of this I have no authentic specimen. It is represented by *Herb. Lugd.-Bat. 905, 282–744*, by a specimen from Kew without a complete sorus. *U. S. Nat. Herb. 825785*, from Blue Mountains, Australia, without further data, seems to be the same; the lips of its involucre are toothed at the apex. Neither of these has a winged rachis, except near the apex, while Willdenow says "rachi alata subserrata." Both authors agree that the lips are toothed, but La Billardière's figure, with teeth on the sides of the valves, is hardly credible.

It may be that, as Cheeseman has stated, this is the species just described as *H. revolutum*, in which case the latter, of course, becomes a synonym.

64. HYMENOPHYLLUM PUMILUM C. Moore. Plate 61, figs. 1 to 3.

Hymenophyllum pumilum C. MOORE, in Baker, Syn. Fil. (1874) 464.
Hymenophyllum Moorei BAKER, Syn. Fil. (1874) 464.

H. pumilum, C. Moore; *rhizome* capillary, wide-creeping; *st.* filiform, ½–¾ in.; *fr.* 1–2 in. l., roundish in upper, cuneate in lower half, flabellate-bipinnatifid; *divisions* ligulate, close, 1-veined, ¼ lin. br., obscurely denticulate, upper simple, lower deeply forked or trifid; *surfaces* naked; *sori* one to a frond, terminal; *inv.* deeply cleft with ovate entire lips.

Hab. Mount Tomah, New South Wales, *C. Moore*.—Syn. Fil. loc. cit.

The United States National Herbarium contains a specimen, from the National Herbarium, Victoria, Melbourne, collected by Moore on Lord Howe Island in 1872—that is, prior to publication, labeled "Hymenophyllum pumilum C. Moore." The locality is the more likely to be correct, because there is another collection by Watts in 1911, from Mount Gower, Lord Howe Island. Domin cites also Mill Creek, in New South Wales.

Fronds 2 to 3 cm long, the more ample ones with a terete rachis above the usually single free lowest pinnæ; pinnæ, the lowest

with three or four segments, the intermediate forked, the higher ones simple, 1.5 to 2 mm wide, apex abrupt but mostly not retuse, teeth few, each consisting of a row of about three cells on a broader base; internal walls slightly, somewhat irregularly thickened; sorus on a short, very narrow apical segment far exceeded by sterile segments; involucre 2 to 3 mm wide, divided down to a broadly obconic base, the lips fimbriate; receptacle slender, half as long as the involucre.

The publication of *H. Moorei* follows immediately that of *H. pumilum* and the sole difference is that the latter is said to have entire lips. Our specimens, labeled *H. pumilum*, is certainly *H. Moorei*. There may have been an error in labeling, but I think it more likely that Baker was in error as to the lips.

65. HYMENOPHYLLUM PUMILIO Rosenstock. Plate 45, figs. 4 and 5.

Hymenophyllum pumilio ROSENSTOCK, in Fedde's Repert. 9 (1910) 72.

Leptocionium; rhizomate repente, filiformi, ramoso, caespitoso, frondiculos 0,5–1,5 cm remotos emittente; stipitibus filiformibus, teretibus, 3–6 mm longis; laminis ovatis, usque ad 5 mm longis, 2–4 mm latis, olivaceis vel olivaceo-fuscis, glaberrimis, pinnatis; pinnis 1–3 utrinque, maximis ad 2 mm fere longis, vix 1 mm latis, alternis, remotiusculis, sessilibus, superioribus breviter decurrentibus, basalibus liberis, omnibus simplicibus, lineari-oblongis, margine dentibus remotis, elongatis instructis, uninerviis; soris apicalibus, magnis, basi altera anguste alatis; indusiis cuneato-oblongis, ad ½ fere bilobis, lobis semicircularibus, antice manifeste denticulatis, receptaculo breviter exserto.

Nova Caledonia: In monte Tao, ad arborum truncos; 1910, *L. Franc no. 1457*.

Diese rasenartig wachsende Zwergform kommt an Gestalt und Grösse dem *Hymenophyllum minimum* Rich. am nächsten, das sich jedoch durch zahlreichere und dichter stehende, stets imbrikate Fiedern, durchweg geflügelte Rhachis, sowie durch dornige Bewehrung der Indusiumklappen von ihr unterscheidet.

Cotypes are in the U. S. Nat. Herb. and the Herb. Univ. Calif. (as *Fil. novocaled. exsicc. 172*). They are as described. Only exceptionally large fronds, with three pairs of pinnæ, have any wingless rachis. The pinnæ are strikingly abrupt at the apex. The cell walls are somewhat thickened at the corners, otherwise uniformly rather thin. Many fertile fronds have a single pair of sterile pinnæ. The involucre is 1 mm wide and slightly longer, but looks huge, compared with the frond. The sides of the tube are straight, and wingless except at the very bottom. The lips are short, very broadly rounded, and beautifully toothed.

The differences from *H. minimum* are not as great as Rosenstock supposed. If the Steward Island material, *Kirk 574*, cor-

rectly represents that species, its pinnæ may be no more numerous nor more imbricate than those of *H. pumilio;* and, as already noted, most fronds of our cotypes of *H. pumilio* have no terete rachis. The one conspicuous and apparently constant distinction is that the involucres of *H. minimum* are armed on the back.

Known by the type collection only.

64. HYMENOPHYLLUM LEVINGII C. B. Clarke.

Hymenophyllum Levingii C. B. CLARKE, Trans. Linn. Soc. Bot. 1 (1880) 439, *t. 49, fig. 3.*

Frond small, narrowly oblong, not crisped, pinnatifid to the winged rhachis; primary segments 1–4-lobate; ultimate segments oblong, remotely serrate, their midrib with many hairs and lanceolar scales of the same texture as the frond. (Pl. XLIX. fig. 3.)

Sikkim; Yoksun and Neebay, alt. 7000 feet, *C. B. Clarke.*

Very delicate in texture. Stipe 1 in., with moniliform hairs. Frond 1–2 in. long, more or less covered with moniliform hairs. The lanceolar scales on the midrib beneath are attached by their whole base; they are sometimes rare, sometimes very numerous, so as to form a thick coat beneath the frond. Involucres usually 1–2 at the end of the segment, small, glabrous, subquadrate, valves separating nearly to the base, entire or slightly toothed at the apex; capsules of Hymenophyllum 2–4 to each involucre, carpophore included.—This is not much like any other species of the genus.

Anything like "lanceolar scales of the same texture as the frond" is otherwise unknown in the family, unless it be the laminar outgrowths of *Amphipterum*, and the broken-up wings of *Ptychophyllum*, *Buesia*, and *Myriodon*. I have seen no specimen of this species. Perhaps it should be regarded as constituting a monotypic subgenus.

7. Subgenus MECODIUM (Presl)

Mecodium PRESL, Epim. (1852 ?) 258.
Diploophyllum VAN DEN BOSCH, Erste Bijdrage (1861) 822.
Eu-Hymenophyllum of many authors.

Fronds pinnately compound or decompound, margins entire and hairless; cell walls typically uniformly thin; indusium cleft to the base, or, if partly immersed, down to the lamina of the frond, receptacle included.

Neither *Mecodium* nor *Diploophyllum* was well published. The former has hardly the pretense of a description, but is authenticated by the citation of a species, *M. sanguinolentum;* the latter is adequately characterized, but no binomial was formed. *Diploophyllum* would be a most inappropriate name for the large group here presented.

I include in *Mecodium* several small aberrant groups and species, with hairy leaves, with toothed margin, and even with laminæ two or more cells thick. In no case have I any doubt that this is their real affinity; and in every case the generic separation of these aberrant plants would result in new difficulties of definition more serious than those it would cure.

I have no other name than teeth for the marginal irregularities of *H. Reinwardtii* and *H. samoense*, but they are not homologous with the teeth of *Meringium*, and do not indicate any affinity to that group.

I cannot recognize the species with lamina more than one cell thick as constituting a subgenus or genus, because they seem each to have its own distinctive affinities to species of ordinary texture. If there had to be a genus *Diploophyllum*, it would probably best have two dissimilar species.

Mecodium is pantropic, and has about fifty Old World species, when *H. polyanthos* is most broadly construed.

Key to the species of the subgenus Mecodium.

Lamina uniformly one cell thick.
Margin entire.
Fronds glabrous.
Receptacle filiform to clavate.
Involucre not subtended by conspicuous branches of costa.
Rachis winged throughout.
Wing of axes plane or at most undulate.
Fronds commonly 5 to 15 cm long.
Fronds odorless.
Lips entire or crenate. (Cosmopolitan.) ..... 67. *H. polyanthos.*
Lips sharp-toothed. (Malaya.) 75. *H. productum.*
Fronds scented. (New Zealand.) 74. *H. sanguinolentum.*
Fronds larger.
Frond linear. (New Guinea.) 69. *H. ooides.*
Frond broader.
Rhizome over 1 mm thick. (New Zealand.).... 109. *H. pulcherrimum.*
Rhizome very slender.
Distal segments elongate. (Hawaii.) ..... 70. *H. recurvum.*
Distal segments not elongated. (Africa.) ....., 68. *H. Kuhnii.*
Fronds smaller.
Involucre roundish.
Lips crenate or lobed. (Philippines.) 71. *H. angulosum.*

Lips entire.
Sori crowded at apex. (Philippines.) ..72. *H. paniculiflorum.*
Sori few or scattered.
Walls uniformly thin. (Japan, etc.)
106. *H. Wrightii.*
Marginal walls toothed. (Luzon.)
73. *H. nitidiuloides.*
Involucre ovate, acute. (New Caledonia.) ..... 86. *H. LePatii.*
Wing crisped.
Lips entire. (China.)... .. 83. *H. corrugatum.*
Lips lobed or subfloccrate.
Receptacle linear. (Malaya, etc.)
80. *H. javanicum.*
Receptacle columnar. (Japan.)
82. *H. riu-kiuense.*
Lips fimbriate. (Philippines.)
81. *H. fimbriatum.*
Rachis terete in lower part.
Fronds odorless.
Pinnæ pinnately divided.
Frond 20 cm long. (Malaya, etc.)
79. *H. emarginatum.*
Frond under 10 cm long. (Philippines.)
71. *H. angulosum.*
Pinnæ rather flabellately divided.
Naked or slightly hairy. (Australia, etc.) .. .. 84. *H. flabellatum.*
Bearing very long hairs. (New Zealand.) ..... 85. *H. rufescens.*
Fronds odorous .... 74. *H. sanguinolentum.*
Involucre subtended by branches of costa; small ferns.
Fronds not deltoid.
Fronds tripinnatifid.
Fronds 4 to 6 cm wide. (Rarotonga.)
88. *H. involucratum.*
Fronds under 2 cm wide. (Madagascar.)
94. *H. veronicoides.*
Fronds simple to pinnatifid.
Internal walls thick. (New Zealand.)
91. *H. montanum.*
Internal walls thin.
Frond normally over 6 cm long. (Australia, etc.)..... 87. *H. rarum.*
Frond normally under 4 cm long.
Pinnæ flat.
Fronds round-elliptic. (Queensland.)..... 89. *H. Walleri.*
Fronds narrower or deltoid. (South Africa.)
93. *H. fumarioides.*

Lower side of pinnæ rolled upward. (New Caledonia.)
90. *H. maioides.*

Fronds deltoid.
Walls thickened and pitted. (Tasmania.)
92. *H. intricatum.*
Walls thin. (Madagascar.).... 96. *H. Humbertii.*
Receptacle capitate.
Wing and lamina flat.
Fronds large, over 10 cm long.
Rhizome slender.
Fronds in general ovate.
Head of receptacle globose. (Malaya; Polynesia.)..... 96. *H. imbricatum.*
Head of receptacle dilated.
Involucre crenate. (Malaya to India.) ..... 101. *H. badium.*
Involucre entire. (Malaya.)
98. *H. Junghuhnii.*
Fronds narrowly lanceolate. (Java to Papua.) ..... 99. *H. longifolium.*
Rhizome over 1 mm thick. (New Zealand.)
109. *H. pulcherrimum.*
Fronds smaller (under 10 cm).
Receptacle dilated. (Java.).... 100. *H. solakense.*
Receptacle not dilated. (Java, etc.)
97. *H. Treubii.*
Wing more or less crisped.
Walls thin, not pitted.
Fronds over 15 cm long.
Segments as wide as wing. (India, Malaya.)
101. *H. badium.*
Segments narrower than wing. (New Zealand.) ..... 108. *H. flexuosum.*
Fronds under 15 cm long.
Sori central on frond. (Japan.)
104. *H. flexile.*
Sori more distal. (India to Philippines.)
102. *H. crispatum.*
Walls thick and pitted.
Fronds thin. (Formosa.)
103. *H. crispato-alatum.*
Fronds coriaceous. (Papua.).... 105. *H. opacum.*
Axes persistently hairy.
Fronds odorless.
Sori distal. (Japan, China.)..... 106. *H. Wrightii.*
Sori axillary. (India.)..... 107. *H. exsertum.*
Fronds odorous. (New Zealand.)..... 110. *H. villosum.*
Margin irregularly, bluntly toothed.
Wing slightly crisped. (Samoa; Queensland.).... 78. *H. samoense.*
Wing moderately crisped. (Malaya.)..... 76. *H. Reinwardtii.*
Wing exceedingly crisped. (Philippines.)..... 77. *H. thuidium.*

Lamina partly or wholly two cells thick.
Rachis winged throughout. (Tasmania, etc.)..... 111. *H. australe.*
Rachis terete below. (New Zealand.)..... 112. *H. demissum.*
Lamina three cells thick throughout.
Hairs on stipe coarse and long. (New Zealand.).... 114. *H. scabrum.*
Hairs ordinary. (New Zealand.)..... 113. *H. dilatatum.*

57. HYMENOPHYLLUM POLYANTHOS Swartz. Plates 46 and 47.

Hymenophyllum polyanthos SWARTZ, Schrad. Journ. 1800 ' (1801) 102 (not seen); Synopsis (1806) 149.
Trichomanes polyanthos SWARTZ, Prod. Fl. Ind. Occ. (1788) 137.
? *Trichomanes inaequale* POIRET, in Lam. Enc. 8 (1808) 74.
Hymenophyllum inaequale DESVAUX, Prod. (1827) 335.
Hymenophyllum gracile BORY, in Willd., Sp. Pl. 5 (1810) 527; HOOKER and GREVILLE, Ic. Fl. *pl. 198.*
Sphaerocionium gracile PRESL, Hymen. 127.
Hymenophyllum emarginatum NEES and BLUME, (spec. *908, 281–725 Herb. Lugd.-Bat.*) et al, *non* Swartz.
Hymenophyllum pectinatum NEES and BLUME, Nova. Acta 11 (1823) 124, *pl. 12, fig. 5*, non CAV.
Hymenophyllum tenellum DON, Prod. Fl. Nepal. (1825) 12.
Hymenophyllum blumeanum SPR., Syst. Veg. 4 (1827) 131; VAN DEN BOSCH, Hymen. Javan. 46, *pl. 36.*
Meringium (?) *blumeanum* PRESL, Hymen. 116.
Hymenophyllum integrum VAN DEN BOSCH, Pl. Jungh. (1856) 563, Hymen. Javan. 40, *pl. 28.*
Hymenophyllum pycnocarpum VAN DEN BOSCH, Pl. Jungh. (1856) 564, Hymen. Javan. 48, *pl. 37.*
Hymenophyllum acrosorum VAN DEN BOSCH, Pl. Jungh. (1856) 564.
Hymenophyllum microsorum VAN DEN BOSCH, Ned. Kruid. Arch. 5[4] (1863) 155.
Hymenophyllum himalaianum VAN DEN BOSCH, Ned. Kruid. Arch. 5[4] (1863) 156.
Hymenophyllum osmundoides VAN DEN BOSCH, Ned. Kruid. Arch. 5[4] (1863) 164.
Hymenophyllum sphaerocarpum VAN DEN BOSCH, Ned. Kruid. Arch. 5[4] (1863) 167.
Trichomanes microchilum BAKER, Trans. Linn. Soc. Bot. II 4 (1894) 250.
Hymenophyllum microchilum CHRISTENSEN, Mitt. Inst. Bot. Hamburg. 7 (1928) 7; Gardens' Bull. 7 (1934) 212.
Hymenophyllum subdemissum CHRIST, Bull. Boiss. 6 (1898) 140.
Hymenophyllum fujisanense NAKAI, Bot. Mag. Tokyo 40 (1926) 249.
Hymenophyllum constrictum HAYATA, Ic. Pl. Formos. 4 (1914) 140, *fig. 80*, non Christ.
Hymenophyllum parallelocarpum HAYATA, Ic. Pl. Formos. 4 (1914) 141, *fig. 82.*
Hymenophyllum punctisorum ROSENSTOCK, Hedwigia 55 (1915) 333.

Hymenophyllum pantotactum v. A. VAN ROSENBURGH, Bull. Jard. Bot. Buitenzorg No. 7 (1912) 20.

Hymenophyllum gracilius COPELAND, Bishop Mus. Bull. 93 (1932) 7, *pl. 3*.

Hymenophyllum epiphyticum J. W. MOORE, Bishop Mus. Bull. 102 (1933) 5.

Frond. tripinnatis deltoideis, rachide stipiteque marginatis, pinnis decurrentibus, pinnulis linearibus obtusis integris. *Flor. Ind. occ.* p. 1757. Hedw. *fil.* ic. Jamaica.—SWARTZ, Synopsis 140.

The usually accepted name of this as a species of the Malay region has been *H. blumeanum*. This is so well established in literature that I quote its publication and Blume's amplification.

H. fronde lineari pinnatifida, laciniis obtusis sub-pinnatifidis. *Java.* (*H. pectinatum* Nees.)—SPRENGEL, loc. cit.

H. fronde lanceolata pinnatifida aut bipinnatifida fusca glabra, pinnis alternis approximatis cuneato-oblongis pinnatifidis, laciniis linearibus subbifidis obtusis parum retusis, involucri valvis subrhombeo-ovatis obtusis, stipite tereti. Spr. Syst. veg. 4. p. 131.4. *Hymenophyllum pectinatum* Nees et Bl. in Act. Nat. Cur. 11 t. 12. f. 5.

Obs. Ab *Hymenophyllum sanguinolento*, Sw., cui proximum, differt fronde angustiore et laciniis seu pinnulis secundariis haud palmato-pinnatifidis.

Crescit in Javae arboribus locis montanis.—BLUME, Enum. 220.

A plant is described here, first as linear, then as lanceolate. It is brownish green, bi- or tripinnate, with narrowly winged rachis; segments narrow, perfectly entire; involucre ovate to broadly ovate. Amplifying the description, the pinnules, at least the basal, tend to be flabellately divided; the segments are short; the internal cell walls are uniformly thin, the marginal ones irregularly thickened or toothed on the inside; and the base of the involucre is broadly winged (that is, sunk in the apex of the segment), cleft down to the wings, the lips broadly rounded or somewhat narrowed towards the rounded tip; receptacle slender, included, with inconspicuous sporangiophores. It ranges from Java to India and New Guinea. It is easily distinguished from typical *H. polyanthos* by the slender fronds, winged base of involucre, and marginal walls.

And yet, I cannot in practice distinguish them, because—

1. The frond form of *H. blumeanum* is not characteristic at all; in more typical (in the sense of the plant, not of nomenclature) development, this plant is in Java narrowly ovate or ovate.

2. The winged base of the involucre is very inconstant; in the type locality (and most other places), the wing may be nar-

row and very short, so that the involucre is cleft almost to the base, and the fertile segment may be narrowed, as in typical *H. polyanthos*.

3. The marginal wall, if constant in Java, is not so in several other parts of the range, where I have found it uniformly thin, and irregularly thickened, on the same fronds.

4. At least along the northern part of its range—India, China, Formosa, and Japan—it blends with typical *H. polyanthos*.

5. *Hymenophyllum polyanthos* in America, as generally construed, exhibits at least an equally wide range of variation—even more synonyms are cited there.

At this point I quote Hooker, Sp. Fil. 1: 107: "The extreme states of this species are indeed easily recognized and easily described; but there are various intermediate grades that baffle all attempts to discriminate them specifically." Christensen also, Med. Goteborgs Bot. Trädgard 1 (1924) 50: "It is difficult to see how *H. blumeanum* can be distinguished from the genuine *H. polyanthos* Sw. from tropical America." Also Rosenstock, on his label of *Mousset Kz.* "(polyanthos Sw.) Blumeanum Spr."

As to the synonyms of *H. blumeanum:*

Hymenophyllum acrosorum was intended to distinguish the form with broader fronds, which I regard as the more typical development; its author almost immediately recognized the identity of the two forms—Hymen. Javan. 47–48.

Hymenophyllum pycnocarpum was described from two specimens from the same locality as *H. blumeanum*, distinguished by somewhat broader frond, less winged base of involucre, and more pointed lips. *Hymenophyllum integrum*, described from one specimen, had a broader, more rounded involucre than *H. pycnocarpum*. With van den Bosch's and abundant other material in hand, I agree with the Buitenzorg pteridologists, Raciborski (who does not mention them), and van Alderwerelt, Malayan Ferns 71, that neither of these is even varietally distinct.

Most botanists since van den Bosch have not recognized *Hymenophyllum himalaianum, H. osmundoides*, and *H. sphaerocarpum* as distinct from *H. polyanthos*, respectively *H. blumeanum*. They are represented in their author's herbarium, in the Herbarium Lugduno-Batavum, by fragments too small and imperfect, by themselves, to permit reappraisal; *H. himalaianum*, described as a very small fern, with flexuous stipe, undulate segments sometimes strongly dilated at the apex, thick walls, and rather large involucres, and compared only with *H. paniculiflorum*, would seem reasonably distinct—by description. I believe that

it is represented by a *Hooker and Thomson* specimen from Khasia (the type source should be Nepal) in the Gray Herbarium; and by a collection by *Strachey and Winterbottom*, cited also by van den Bosch. Like these are a collection by Mann from Assam, and *Kerr 6083* from Siam. To me, they are all dwarfed *H. polyanthos* with large sori.

Hymenophyllum osmundoides is clearly of the group of *H. polyanthos*, and may represent that species, though it could not so well be *H. blumeanum* if they were to be distinguished. The lobes of its involucre are described as "triangularibus patulis, antice s. acutis, s. oblique truncatis, s. emarginatis;" on the type fragment they are elongate-triangular and very acute, as in some forms referable to *H. subdemissum*. Judging by this fragment, it is represented by a *Hooker and Thomson* specimen in the United States National Herbarium, probably a cotype. Like this are *Mann s. n.* from Assam, *Matthew s. n.* and *Dalziel s. n.* from South China, *Cavelerie 1326*, and *Pételot 411* and *3913* from Indo-China. *Chevalier 30904* is similar but depauperate. *Chevalier 30902* is *H. blumeanum*.

Hymenophyllum sphaerocarpum is otherwise similar, but has involucres circular in outline on contracted fertile segments. The Gray Herbarium contains a probably cotype, *Hooker and Thomson s. n.*—doubtful because of the absence of any collector's number, and a lower stated altitude. Like it are *Hooker and Thomson 332*, *Clarke 44739*, from Khasia; *Clarke 36429*, from Sikkim, is similar except that the sori are along the main rachis; *Kanehira and Sasaki 21658* can represent this or the ill-distinguishable *H. punctisorum*.

None of the foregoing have the dentate-thickened marginal walls of *H. blumeanum*. The material being too limited for really final judgment, I leave these "species" at peace; but more ample material may show them to be locally well defined.

Hymenophyllum microsorum was accepted by Hooker and Baker, Synopsis 59, as a species "Intermediate in habit between *H. exsertum* and *H. polyanthos*." I cannot distinguish it by description from *H. blumeanum*, but the type fragment has somewhat broader laciniæ. Even this distinction does not hold with specimens from Burma, *Rock 7396*, and Yunnan, *Hancock*, identified by Christensen as *H. microsorum*, but with the previous avowal, op. cit. (1924) 50, that the species is not distinct. Other specimens are *Levinge* from Sikkim; *Eberhardt*, and *Pételot 582* from Tonkin. The marginal walls are characteristically (that is, in the manner of *H. blumeanum*) thickened. Beddome wrote

the name of this fern *H. microglossum*, in error, and was also confused in ascribing its type locality to southern India instead of to Sikkim.

Hymenophyllum microchilum (Baker) C. Chr. was described from Mount Kinabalu, from which type locality I have *Clemens 27070* identified by Christensen after he knew the type, *Haviland 1478*, in Kew. Other specimens in hand are *Clemens 31145* from the type locality, and *Clemens 20738* from Sarawak. Christensen cites specimens from all parts of Borneo. On *Clemens 27070* are involucres cut from less than a quarter to more than half of the way down (usually about one-third), with the lips varying from obtusely triangular to very broadly rounded. The extreme shortness of lip (less than one-fourth the length of the involucre) is matched by several Tahiti specimens, which, like those of Borneo, have the marginal walls, at least in part, toothed on the inside, as in *H. blumeanum*. The range in frond form is that familiar in *H. blumeanum*, *Clemens 20738* having the narrow form. If this species has really and normally an exserted receptacle, it is probably not even a near relative of *H. polyanthos;* but the specimens I have cited have very slender receptacles definitely shorter than the involucre.

I cannot distinguish *H. microchilum* specifically by the short lips, because on the individual frond their length varies to that of typical *H. blumeanum*—cleft halfway down.

Also from Kinabalu, *Clemens 40984*, comes a specimen which exhibits the other extreme of involucre, cleft actually to below the base(!), because it is not winged at all, and the base is retuse or subcordate, the vein becoming the receptacle at a point above the rest of the basal line. In any other group, extremes as conspicuous as this and *H. microchilum* would hardly be questioned as representing distinct species.

Hymenophyllum subdemissum was later construed by its own author, Philip. Journ. Sci. § C 2 (1907) 155, as *H. pycnocarpum*. In my opinion, it is endemic in the Philippines, with larger sori than *H. pycnocarpum*, the valves pointed, and longer than broad. Although typical *H. blumeanum* is found throughout the Philippines, it and *H. subdemissum* do not intergrade nearly as perfectly as do *H. blumianum* and *H. pycnocarpum* in Java. Neither does typical *H. pycnocarpum* have as acute valves as *H. subdemissum;* but in this respect some specimens from Sumatra (for example, *Matthew 666*) are like those of the Philippines. Philippine specimens are: *Cuming 864; Bur. Sci. 9807, 29702, 40629, 41905, 41988, 76538, 76540, 76555 part, 77216, 77217,*

78697, 80349; For. Bu. 4464, 7955; Whitford 922; Merrill 7141, 6919; Elmer 8962, 10230, 18014. In Negros and Mindanao the valves tend to elongate: examples, *Merrill 6917, 6948, Banks s. n.* from Negros; *Bur. Sci. 14773, 83462* from Mindanao. The valves may be fully twice as long as broad, with a very sharp point. In the same region occur plants with the valves elongate but rounded. The range is throughout the Philippines, except Palawan; and *H. blumeanum* has the same Philippine range. Of specimens known to me from elsewhere, the most similar are those already cited as *H. osmundoides.*

Hymenophyllum constrictum Hayata, non Christ, as described, is a local derivative of *H. blumeanum,* from the broad form of which it differs in being still broader and more dissected, and in the conspicuous constriction of the fertile segment immediately below the sorus. The cells are large, with very thin, even walls. The receptacle is cylindrical, about two-thirds as long as the involucre, with evident sporangiophores. The involucre may be round, or somewhat narrower or wider. I have not seen the type collection, but I have *Faurie 629* in the Phil. Nat. Herb., received without name, and *Kanehira 21658* in U. S. Nat. Herb., as *H. blumeanum,* both from Mount Arisan, the type locality. Other specimens are *Baker 14, Hancock 9* at least in part, and *Hayata* and *Sasaki,* from Formosa; *Loher 1199,* from Luzon.

By Hayata's figure and description, this would appear to be a distinct enough local daughter species, wanting only a tenable name. This name was provided the next year—*H. punctisorum,* described independently from the same mountain, Arisan—but this occupies the gap between *H. constrictum* Hayata and *H. blumeanum.* Faurie's specimen already cited is ample, and its fronds blanket *H. constrictum* and *H. punctisorum.* There are similar Chinese specimens, probably *H. sphaerocarpum,* from which the Formosa plant is hardly distinguishable.

I have no authentic specimen of *H. parallelocarpum,* and follow Nakai, Bot. Mag. Tokyo 40 (1926) 248, who reduced it to *H. blumeanum.*

In publishing *H. fujisanense,* Nakai cites several collectors but no numbers, so that I may or may not have any of the cited collections. He distinguishes it from what he calls *H. integrum* solely by the narrow frond, which, in this group, is usually no distinction at all.

Hymenophyllum pantotactum v. A. van Rosenburgh is described as "frondes . . . angustissimae lanceolatae, latissimae

deltoideae et ad basin latissimae," and as about as variable in other respects. I have not seen the type collection, but find nothing in the description to exclude it even varietally from *H. blumeanum*. *Palmer and Bryant 629*, from Mount Salak, altitude 1,600 m, where *H. blumeanum* in various forms is common, has one frond 30 cm long by 1 cm wide, and one 13 cm long by 10 cm wide, deltoid in outline, beside others of more common shapes.

The plant of the Society Islands, represented by *Vesco s. n.*, *Brackenridge* (as *H. gracile*), *MacDaniels 1553*, and *Grant 3562, 3728, 4221, 4492*, and *4982*, distributed partly without name, partly as *H. dilatatum*, usually has the involucre cleft one-third to half of the way down, with apparent vein branches subtending it; marginal walls toothed on the inside in some places, in others not so. The *Vesco* specimen resembles *H. blumeanum* in aspects, and is possibly the collection referred to by van den Bosch, Hymen. Javan. 47, 48 (*Vieillard and Pancher*), which is not in his herbarium. The recent collections are green, not brownish. The sori are wider than the segments. They are characterized by irregular length of pinnæ and especial width of the pinnules adjoining the rachis—tendencies of this species in other lands.

With the specimens just cited in hand, four years ago I described *H. gracilius*, based on *Grant 3766*, as distinct, characterized by the involucre cut halfway down (or a little farther), narrower segments and wing, and fertile segments contracted below the sorus. None of these distinguishes it from forms of *H. polyanthos* common elsewhere; and my present belief is that when it is collected again, there will be found also intermediate forms between it and its local relatives. This opinion applies also to *H. epiphyticum* Moore, the only peculiar feature of which is its winged stipe. It assumes the brownish color common in *H. polyanthos*.

Besides these named forms and varieties, there are others fully as worthy of name. *Hymenophyllum blumeanum* var. *novoguineense* Rosenstock, *Warner 49 a*, from Mount Gelu, well developed, is superficially less like *H. polyanthos*, or *H. blumeanum*, than is any form I reduce to synonymy. The cotype in Herb. Univ. Calif. bears two fronds over 45 cm long excluding stipes of 10 and 14 cm; one is 5, the other 10 cm wide. It has pinnæ up to 10 cm long. By size alone, it is a better "species" than most that I reduce. Besides the type collection, which in

U. S. Nat. Herb. is *Rosenstock Fil. Novoguin. Exsic. 55*, we have it as *205* of that series and as *Bamler 50 p*, from the Sattelberg, *Schlechter 16496*, and *v. Leeuwen 9185, 10129, 10320*, and *10368*. All the rest of these are variously intermediate between the type and ordinary *H. blumeanum*, which is represented by *v. Leeuwen 9467*. Nearly all of these are ample collections, with some fronds unmistakably representing the variety, others passable as *H. blumeanum*. Now, typical var. *novoguineense*, by itself, is different enough from *H. blumeanum* almost to demand specific recognition. The other collections cited may be presumed to be capable, genetically, of the same development. The mere capacity to develop in a characteristic manner may be a good specific character; it is a very familiar generic character in mycology. However, I leave it as a variety, both because it is only an assumption that the intermediates might develop further, and because, as a matter of convenience, the idea of two species in the same area, but sometimes indistinguishable, is abhorrent.

There are in the southern Philippines, besides typical *H. blumeanum*, small ferns much like it, but with large, broad lips, the involucre subtended by conspicuous apparent branches of the vein; *Bur. Sci. 44504*, from Tawitawi, is the best example. I give these on the labels the epithet *pseudorarum*. *Singapore field No. 10275*, from Kelantan, is similar. *Hymenophyllum rarum* is credited to Ceylon by Hooker, Sp. Fil. 1: 101, but not in later works by the same school (Baker, Beddome), and this seems to be due to renaming the specimens as *H. polyanthos* or *H. blumeanum*. *Herb. Lugd.-Bat. 908, 282-671* is from Herb. Hooker as *H. rarum*, determined as *H. blumeanum* by Rosenstock. It has the dilated fertile segments characteristic of *H. rarum*. I suppose that it is an aberrant *H. blumeanum*, another *pseudorarum;* but it remains possible that Hooker named it correctly.

Wherever *H. blumeanum* occurs the environment may effect dwarfing, most conspicuous, of course, when it operates in this way on a form or strain naturally small. The most extreme example I have seen is *Bur. Sci. 16661*, from Luzon, with freely fertile fronds 15 mm long, stipe included, Plate 47, fig. 7. The largest fronds of the collection measure less than 3 cm. I describe another dwarf as a distinct species, because it is changed in other ways as well as in size.

Notably slender fronds are occasionally found almost anywhere. *Brooks 162*, from Sarawak, measures, stipe excluded, 23 cm by 18 mm. Ceylon plants seem mostly to be slender—

for example, *Thwaites 1891; Moon 63* is slender but with uniform pinnæ.

From Africa (*Stoudt 370*) to Australia very lax fronds are occasionally found. The most extreme of these is from Camiguin de Mindanao, *Bur. Sci. 14845*, Plate 47, fig. 6, which I illustrate because written description would hardly make it credible.

In Mauritius this would be *H. gracile*, which, if it were found only in Mauritius, I would regard as a local species. When, however, we have substantially the same form from the Philippines and from Kamerun (*Staudt 370, Zenker 3880*), the practical alternatives are to try to recognize two, or three, or more indistinguishable local species, or to construe them all as *H. polyanthos*. We have the evidence in form of intermediates that the Philippine form is of local origin and not well fixed. Single Mauritius collections (old Kew distributions in Herb. Lugd.-Bat.; *Mrs. Pike* in U. S. Nat. Herb.) show that *H. gracile* in its type locality may have straight or zigzag rachises, and is as variable as aberrant forms are prone to be, in laxness, in width of pinnæ, and in size of involucre.

Hymenophyllum inaequale, to which *H. gracile* has long been reduced, is known to me by two collections, *Hildebrand 3778*, and *Humbert 3504*. These are two of three Madagascar specimens, all alike, known to Christensen, Dansk bot. Arkiv 7 (1932) 11, who finds them so near to *H. polyanthos* that he doubts the correctness of the identification and questions the occurrence of *H. inaequale* in Madagascar. They agree very well with Poiret's description; and Madagascar is the stated source of the type. They are not nearly as distinct a form as is *H. gracile*, and I do not hesitate to include them in *H. polyanthos*.

I have already noted that from the Himalayas to Japan specimens are present which represent *H. polyanthos*, but not any Old World form which I reduce to that species; I do not cite specimens because most are without collectors' numbers. Among these, however, *Wallich 172* must be discussed, because, as it is recognized as *H. polyanthos* by Hooker, Sp. Fil 1: 102, I see no reason to doubt that it is *H. tenellum* Don, which Hooker listed, page 112, as a "dubious species." This species was published with citation of collections, without numbers, by Hamilton and Wallich, from Nepal. Van den Bosch, Synopsis 61, preserved it, citing without number "Wall. (spec. ex dono, Lambert in Herb. Sond.)" His unpublished manuscript in Herb. Lugd.-Bat. *910.38–106* shows that he saw the collections of both Hamilton and Wallich in the Herb. Sonder, and that *Wallich 172* in the

Herb. Hooker is the same. His description and sketches, and the fragment in his herbarium, permit no question that it is what I construe as fairly typical *H. polyanthos*.

The following collections are cited to authenticate the specimens and places: Fiji, *Parks 20769*. Samoa, *Whitmee*, *Powell*, *Betche*; *Reinecke 62, 175*. Marquesas, *Mumford* and *Adamson 360*, with broader segments than typical.

Great as is the range of forms assembled here as one species, there are evident trends within which the variability is manifested in one after another of the described species. The presence of almost linear and of broadly lanceolate or even ovate fronds is known in almost all of them—in all which have been freely collected, unless the narrow form is "excluded" by definition. The broad form develops, of course, from the narrow by elongation of the pinnæ, and fronds of irregular form, with pinnæ of very unequal length, are found from Africa and Ceylon to Tahiti. With any tendency to laxness, the rachis is usually flanked by short, broad, flabellate acroscopic pinnules, giving the frond a more compact middle line. If laxness is considerable, whether because of few or of narrow segments, the rachis tends to be zigzag. There is a limited correlation between laxness and narrow and pointed involucre valves.

The reader will probably find my presentation of this species or group unsatisfactory; it is so to me. In so wide-spread and varied a group, it is usually possible to give some kind of definition to species of limited distribution, as with some limited success I have essayed to break up the group of *Trichomanes rigidum*, even if into species hard to distinguish if of unknown origin. *Hymenophyllum polyanthos* is more variable, and variable in more respects, convenient for definition. But, in repeated attempts to recognize and maintain species described and easily distinguished by their types, I have in every case been forced to conclude, if many specimens were available, that the "species" was not well defined even locally.

68. HYMENOPHYLLUM KUHNII Christensen. Plate 48.

Hymenophyllum kuhnii CHRISTENSEN, Index (1905) 363.

Hymenophyllum Meyeri KUHN, in Engler, Hochgebfl. Trop. Afrika (1892) 94, non Presl (1843).

Rhizomate elongato tenero; foliis membranaceis glaberrimis siccitate badiis; petiolo tenero tereto; rhachi anguste alato-marginata, lamina elongato-lanceolata tripinnatipartita; laciniis primariis patentibus elongato-lanceolatis apice obtusis, secundariis trapezio-oblongis obtusis, ultimis paullo elongatis obtusis; soris lacinulas laterales internes occupantibus, lati-

tudine laciniarum statu evoluto latioribus basi manifeste immersis, labiis profunde divisis elongato-obtusis integerrimis, cruribus in basi manifestis, columella inclusa parva.

Foliorum petiolus 1–2 cm longus, lamina 10–50 cm longa, 2–6 cm lata. *Hymenophyllo sphaerocarpo* v. d. Bosch (Ned. Arch. V, 167) affine, sed soris elongatis et auribus in basi labiorum satis distinctum.

Kilimandscharo, im Urwald am Südabhang massenhaft von 1930–2800 m (v. Höhnel 146, 147, Ehlers n. 66); im oberen Urwald um 2500 m (H. Meyer Aug. (1881), am Ruabach, 1900–2300 m, Waldpfl. (H. Meyer 310).

I know this species by *Rosenstock, Fil. Africae or. germ. exsic. I, Daubenberger*, from Kilimanjaro, altitude 3,000 to 4,000 m, the type locality, in U. S. Nat. Herb., Herb. Univ. Calif., and Herb. Copeland. There is in Herb. Lugd.-Bat. *908, 282–296, Busse 271*, a sterile specimen bearing this name, not distinguishable from *H. polyanthos*. Neither can I distinguish the Daubenberger collection by the characters emphasized by Kuhn—sorus longer than in *H. sphaerocarpum*, which is true also (relatively) of typical *H. polyanthos*, and *cruribus* or *auribus* in the base of the involucre, equally conspicuous in the Philippine form which I call *pseudorarum*.

However, as represented by the fairly uniform Daubenberger collection, and as described, this species is larger than any form of *H. polyanthos* except var. *novoguineense*, peculiar enough in form, so that, considering also the apparent vascular branches (*cruribus*) subtending the involucre, it seems to constitute a well enough established local derivative to merit specific recognition. However, it is approached by other plants of the same region which I leave in *H. polyanthos* (*Last*, in U. S. Nat. Herb.).

The well developed fronds are about 30 cm long, including stipe, 2 to 3 cm, and 5 cm wide, linear-elliptic in outline, rachis slightly zigzag and very narrowly winged, pinnules quite uniform and the pinnæ therefore symmetrical, segments 0.7 to 1.2 mm wide, 2 to 4 mm long; walls, marginal and others, uniformly very thin; involucre orbicular or somewhat elongate, up to 1.2 mm wide, the apex broadly rounded or with an obscure point.

43. HYMENOPHYLLUM OOIDES F. von Müller and Baker.

Hymenophyllum ooides F. v. MÜLLER and BAKER, Journ. Bot. 23 (1890) 105.

Stipe short, thread-like, glabrous. Fronds lanceolate, 2–3-pinnate, pendulous, glabrous 6–9 in. long, at most an inch broad; rachis thread-like. Pinnæ very numerous, lanceolate, ascending, those in the centre of the frond the largest, usually simply pinnate, rarely with small pinnate pinnules. Ultimate segments obovate, obtuse, 1-nerved, emarginate, crowded, about 1/12 in. long, more or less crisped and complicated. Sori small,

terminal on the ultimate segments. Indusium immersed at the base in the lamina of the segments, its valves cuneate with a rounded margin.—New Guinea highlands, alt. 9200 ft. A very distinct species, allied to *H. undulatum* and *crispum*.

Of this species I have *King 106*, a juvenile frond identified by Bailey, and *King 246*, fully developed. The former could pass as the linear form of *H. blumeanum*. The latter transcends it enough to merit specific recognition.

Stipe finely filiform, marginate in the upper part; frond 27 cm long, 3 cm wide at the middle, thence narrowed to both ends, rachis filiform, narrowly winged throughout; pinnæ close, ovate rather than lanceolate, their segments simple, or on the larger pinnæ once or twice dichotomously cleft; laminar tissue dark and nearly opaque because of the dark cell contents, walls thin, the marginal ones slightly, irregularly thickened; sori on distal, distal and acropetal, or all segments of the upper pinnæ, involucre up to 1.5 mm long and 0.9 mm wide, base immersed, lips rounded, entire; receptacle slender, included (the tip seen extruded in two sori).

Derived from *H. polyanthos*.

Known from eastern New Guinea only.

78. HYMENOPHYLLUM RECURVUM Gaudichaud. Plate 49.

Hymenophyllum recurvum GAUDICHAUD, in Freyc. Voy. Bot. (1827) 376.

H. frondibus bipinnatis (6–8-pollic.), pinnis elongato-recurvatis; pinnulis dichotomo-pinnatifidis; laciniis simplicibus; elongatis, integris; soris supra axillaribus, solitariis; indusiis ovatis; rhachi stipiteque alatis; caudice filiformi repente.

In insulis Sandwicensibus (Mowi. Alt. 500–550-hexap.).

L'*hymenophyllum recurvum* croît sur les montagnes élevées de l'île Mowi, au pied des plus grands arbres, parmi les mousses. Il est remarquable par la disposition recourbée de ses divisions supérieures, qui sont simples, linéaires souvent très-alongées; ce que donne à cette petite plante l'aspect d'un saule pleureur. Les fructifications sont solitaires, fort grosses, ovales, à tégumens entiers ou légèrement émarginés, libres dans presque toute leur longueur. Parmi les échantillons de cette fougère, glabre dans toutes ses parties excepté sur la tige, il s'en trouve quelque-uns non encore bien développés, écailleux, à écailles piliformes, capillaires, articulées, ce qui doit faire supposer ou que cette plante est velue dans sa grande jeunesse, ou qu'une espèce nouvelle, très-voisine de celle-ci, se rencontre dans la même localité. *Hymenophyllum* (aut *trichomanes*) *pilosum?*

Known on all the larger Hawaiian islands, and nowhere else.

Stipe, 1.5 to 8 (commonly 5) cm long, one-tenth to one-fourth the length of the frond; rachis and upper part of stipe narrowly winged, or merely marginate in the lower part; pinnæ, pinnules,

and segments usually remote on large fronds, which are therefore conspicuously lax, segments about 1.2 mm wide, hardly narrowed below the sori; lowest pinnæ usually reduced, the medial or supramedial ones often prolonged; sori on short, basal acropetal branches of the pinnules; involucre oblong to round, 1.3 to 2 mm wide, the margin usually entire; receptacle and sporangia included, the former fertile in its upper half, not at all enlarged, the sporangia practically sessile.

Although our material of Gaudichaud's collection has few sori, I have thought it best to use it for illustration.

11. HYMENOPHYLLUM ANGULOSUM Christ. Plate 50.

Hymenophyllum angulosum CHRIST, Philip. Journ. Sci. § C 3 (1908) 269.

Caespitosum, stipite rhachique inferiore obsolete exalatis, fronde bi- et ad basin tripinnatifida, fronde sterili late flabellata, fertili elongata, laciniis elongatis divaricato-furcatis, marginibus laevibus integris, soris terminalibus, valvis crenatis, late ovatis.

Habitu *H. capillacei* Roxb., Ins. S. Helenae, et *H. inaequalis* Poir. Africae, sed minus, minusque compositum, laciniis latioribus.

Rhizomate caespitoso-repente filiformi, nigro, glabro uti tota planta, stipite 1.5 ad 3 cm longo stricto tenui obsolete exalato, fronde sterili subflabellata 3 cm lata et longa, bi-, infra tripinnatifida, rhachi supra anguste alata nigra, pinnis 3 vel 4 utrinque cuneato-flabellatis, infimis 6-partitis superioribus tripartitis, laciniis ultimis 4 mm longis 1.5 mm latis obtusis linearibus diaphanis nervo nigro praeditis; fronde fertili ovato-oblonga basi attenuata, 7.5 cm longa, 3 cm lata, subtripinnatifida, pinnis 7 utrinque; frondo versus apicem acuminatum sorifera, soris in laciniis terminalibus, 1.5 mm latis, rotundato-ovatis, valvis crenato-denticulatis. Textura tenui, colore dilute fusco-virento.

MINDORO, Mount Halcon, *Merrill 6080*, November, 1906.

There is a second, identical collection from the same place, *Bur. Sci. 40555;* an earlier collection from Mount Banahao, *Whitford 919*, had been distributed partly unnamed, partly as *H. Trenbii* in error; recent collections from Batan Island, north of Luzon, are *Bur. Sci. 80346* and *80348*. The range is thus Luzon and adjacent islands. *Merrill 6082*, from the type locality, larger and with protruding receptacles, has been taken for an aberrant *H. emarginatum*, but is more probably *H. angulosum*.

The plant is in no sense dimorphous, what Christ described as sterile fronds being dwarfed or juvenile. The segments are about 1 mm wide. The rachis is narrowly winged in the upper part, not at all in the lower. The Batan Island specimens are larger than typical, with filiform stipes up to 9 cm long, and fronds up to 11 cm long and 4 cm wide.

There is a superficial resemblance between this species and *H. Treubii*, both having small fronds and few segments, but the affinity is not close. *Hymenophyllum angulosum* may be a reduced relative of *H. emarginatum*.

72. HYMENOPHYLLUM PANICULIFLORUM Presl. Plate 31.

Hymenophyllum paniculiflorum PRESL, Hymen. (1843) 147; VAN DEN BOSCH, Hymen. Japan. 49, *pl. 32*; CHRIST, Philip. Journ. Sci. § C 2 (1907) 155.

Hymenophyllum coloratum Al. Br.: VAN DEN BOSCH, Pl. Jungh. 1 (1856) 565, *teste* van den Bosch, Ned. Kruid. Arch. 5ª (1863) 198.

Hymenophyllum discosum CHRIST, Bull. Boiss. 6 (1898) 140.

H. glaberrimum, fronde ovata obtusa, tripinnata, pinnis petiolulatis ovatis obtusis, pinnulis primariis lanceolatis obtusis, secundariis linearibus indivisis obsolete emarginatis integerrimis, stipite basi tereti apice rachibusque alato, soris in apice frondis paniculatis, indusii usque fere ad basim bifidi laciniis orbiculatis receptaculum superantibus.
Cuming pl. philip. exs. n. 214.

Habitat in insulis Philippinis, verosimiliter in insula Luzon, ubi legit clar. H. Cuming.

Rhizoma ignotum. Herbula glaberrima. Stipes semipollicaris, subflexuosus, fuscus, filiformis, inferne teres nudus, apice alatus, ala integerrima. Frons seu frondis limbus sesquipollicem longa, pollicem lata, ovata, utrinque obtusa, tripinnata, exsiccata purpurascens. Pinnae alternae, petiolulo semilineali instructae, ovatae aut ovato-lanceolatae, obtusae. Pinnulae primariae lanceolatae, obtusae, basi acutae, secundariae lineares, indivisae, obtusae, apice laeviter aut non emarginatae, integerrimae, planae. Rhaches petiolulique alatae, ala integerrima. Venae simplices, fuscescentes, apice liberae. Parenchyma e cellulis hexagonoideo-subrotundis constructum. Sori in pinnis terminalibus omnibus fructiferis paniculae terminalis in modum dispositi, apicales, sessiles in pinnis pinnulisque reliquis angustioribus. Indusium tres quartas lineae partes longum, usque fere ad basim bifidum, laciniis orbiculatis adpressis disco convexis integerrimis. Receptaculum indusio triente brevius, cylindricum, obtusum, undique capsuliferum. Capsulae lenticulares, sessiles.

Vidi solummodo duo specimina, unum sterile parvulum, alterum fertile supra descriptum. An omnia specimina fertilia soros in panicular terminalem dispositos gerunt? Species caeterum distinctissima.—PRESL, loc. cit.

A small plant recognizable by its large sori which are ovoid or globose, terminal and occupying all the segments at the summit of the frond.

LUZON, Province of Benguet, Mount Tonglon, 2,250 m. alt. (*Loher*) April, 1904. Identical with specimens from Java, leg. *Giesenhagen* and *Raciborski*, and with specimens from Japan, leg. *Faurie*.

I am now of the opinion that *H. discosum* Christ, Bull. Herb. Boiss. 6 (1898) 140, should be united with this species, although the sori are much broader and more round than those in the Javan Plant, leg. *Giesenhagen*.—CHRIST, Philip. Journ. Sci. § C 2 (1907) 155.

Frond commonly 5 cm or less long, ovate, with uniformly narrowly winged rachis, and ultimate segments a scant half-millimeter wide; sori of fully fruiting fronds terminating all segments of the upper third or half of the frond; involucre divided nearly to the base, with ovate to orbicular entire valves, fully twice as wide as the segments, or still wider; receptacle cylindrical, without conspicuous sporangiophores.

The walls between the laminar cells are uniformly thin. The marginal wall of our cotype is uniformly very thin in some places, slightly and irregularly thickened in others. In some Philippine specimens it is very evidently toothed, although less remarkably so than in van den Bosch's figure, Hymen. Javan. pl. 39, fig. 7.

A relative of *H. pycnocarpum*, well distinguished by the wider segments and sori, and the absence of sterile segments in the upper part of fruiting fronds. The color is usually a brownish green, less brown than is usual with *H. blumeanum*.

Hymenophyllum discosum as described would perhaps be distinguished by round, instead of ovate involucres. Both forms occur both in Java and in the Philippines; they are ovate on our Philippine cotype. If there is any difference between Javan and Philippine specimens, it is that the former have the rachis more narrowly winged, sometimes apparently wingless at the base.

Inconspicuous, but not rare on high mountains in Benguet, Luzon. Philippine collections: LUZON, locality unknown, *Cuming 214* (cotype in Phil. Nat. Herb.), (*Loher*, type of *H. discosum*); Bontoc Subprovince, Bauco, *Vanoverbergh 1757*: Benguet Subprovince, Mount Pulog, *F. B. 16816 Curran, Merrill, and Zschokke, 11070 Whitford, Merrill 6373, 6374, 6386, Bur. Sci. 44885 Ramos and Edaño;* Haight's Place, *Bur. Sci. 4235, 4236 Mearns:* Zambales Province, Mount Pinatubo, *Bur. Sci. 2550 Foxworthy.* MINDANAO, Bukidnon Province, Mount Lipa, *Bur. Sci. 38565 Ramos and Edaño.* NEGROS, *Merrill 6917* in Herb. Lugd.-Bat. *nec alibi.* Apparently rare in Java, where van den Bosch cited only a collection by Al. Braun. There are several sheets in Herb. Lugd.-Bat. ex Herb. Waitz. More recently collected on the Gedeh-Pangrango, *Raciborski, Copeland,* and *Yates 2326.* BORNEO, Mount Kinabalu, *Clemens 51543* (also *teste* Christensen and Holttum, Gardens' Bull. 7 (1934) 213, *Holttum 25497, Clemens 28014*). So far as I have seen specimens from Japan, China, *et alibi*, bearing this name, I believe that it is incorrect.

72. HYMENOPHYLLUM NITIDULOIDES Copeland sp. nov. Plate 62.

Rhizomate intricato, vix ultra 0.1 mm crasso, obscuro, glabrescente; stipite tenuissimo, 1 ad 2 cm alto, terete, nudo; fronde 15 ad 25 mm longa, forma varia, nunc subflabellata, nunc pinnatifida segmentis furcatis, glabra, costis ubique alatis; segmentis usque ad 8 mm longis, 1 ad 1.5 mm latis, integris; parietibus marginalibus plerumque dentibus obtusis incurrentibus praeditis, internalibus diaphanis, huc molliter illuc irregulariter subincrassatis; soris segmenta (infimis exceptis) terminantibus, involucro orbiculare basi late cuneata immerso, adhuc bilabiato labiis integris rotundatis, receptaculo breve, cylindrico.

LUZON, Sorsogon Province, *Bur. Sci. 23577 Ramos*, September 9, 1915 (type in Phil. Nat. Herb.).

This is a dwarf derivative of *H. polyanthos*, so changed in aspect with the reduction in size that its specific distinction is expedient. It has remained two decades in the herbarium, without a suspicion as to its affinity, annotated as "*Microtrichomanes*."

74. HYMENOPHYLLUM SANGUINOLENTUM (Forster) Swartz. Plate 63.

Hymenophyllum sanguinolentum (Forster) SWARTZ, Schrad. Journ. 1800[2] (1801) 101 (not seen); Synopsis 148, 376; SCHKUHR, Krypt. Gew. 136, *pl. 135 c*; HOLLOWAY, Trans. N. Z. Inst. 54 (1923) 588, *pl. 57*.

Trichomanes sanguinolentum FORSTER, Prodromus (1786) 84.

Sphaerocionium sanguinolentum PRESL, Hymen. (1843) 35.

Mecodium sanguinolentum PRESL, Epim. (1849) 258.

Hymenophyllum polyanthos HOOKER, Sp. Fil. 1: 107, part., non Swartz.

H. lophocarpum COLENSO, Trans. N. Z. Inst. 17 (1884) 255.

Hymenophyllum cristulatum ROSENSTOCK, Fedde's Repert. 5 (1908) 14.

T. sanguinolentum, frondibus subbipinnatis, foliolis alternis pinnatifidis: pinnis dichotomis lineari-oblongis obtusis integris decurrentibus: fructificationibus ovato-subrotundis dehiscentibus. F.

Nova Zeelandia.—FORSTER, loc. cit.

Stipe one-third to half as long as the lamina, terete, nearly black; lamina commonly 10 cm long but sometimes fully fertile 5 cm long, usually ovate but varying from lanceolate to deltoid, base contracted or broad, dark, compact, usually tripinnatifid, but secondary pinnules sometimes forked, segments 1 mm wide, 3 to 4 mm long; rachis narrowly winged with raised edges, or sometimes wingless near the base; marginal walls thin in some places, coarsely dentate-thickened in others; other walls thin; sori winged at base only, involucre cleft to the wing, 1.5 mm wide, ovate or broader or oblong, margin usually quite entire;

receptacle included, cylindrical, with inconspicuous sporangiophores.

The involucre is remarkable, unique in its group, in that it may bear thickenings or crests on the outside near the base, such as are characteristic of the groups of *H. denticulatum* and *H. fuscum*. These were known to Hooker, Sp. Fil. 1: 107; "in one of Dr. Logan's specimens the involucres have crested lamellae." In the unpublished notes of van den Bosch I find "lobis" [indusii] dors. irregulariter gibberosis vel appendiculatis." Some such sori can be found on many or most specimens if they are sought with sufficient care. The outgrowths vary from apparently absent, to evident on all sori, as in the case of *Ranft 1, Rosenstock Fil. Novae-Zeal. 11*, the type collection of *H. cristulatum*. Of specimens in hand, the most conspicuous in this respect is *Brame s. n., U. S. Nat. Herb. 1371318*. The suggestion obtrudes itself that we are dealing here with a hybrid of *H. denticulatum* and an original *H. sanguinolentum* or *H. polyanthos* with smooth involucre.

Apparently common in New Zealand. As the many specimens are correctly named, or named *H. polyanthos* which is not found in New Zealand, citation is unnecessary. The only very aberrant one in hand is *Kirk 561* in U. S. Nat. Herb., with a frond 30 cm long, and a pinna 14 cm long by 15 mm wide, recalling *H. blumeanum novoguineense*.

This species is related to *H. polyanthos*, which it represents in New Zealand, and from which in general it is distinguished by a blackish stipe, darker fronds, raised margin of wing of rachis, and larger or at least wider sori. Its most distinctive character is the odor, strong on all herbarium specimens less than 30 years old, and evident after more than 80 years.

78. HYMENOPHYLLUM PRODUCTUM Kunze. Plate 54.

Hymenophyllum productum Kunze, Bot. Zeit. 6 (1848) 305; van den Bosch, Hymen. Javan. 56, *pl. 45*.

Hymenophyllum demissum, partim, auct. mult., non Swartz.

Fronde subcoriacea, tenui, olivacea, pellucente, fusco-nervosa, ovato-oblonga, acuminata, curvato-flexuosa, basi in stipite decurrente, subbipinnato-pinnatifida; pinnis patenti-erectis, trapezio-ovato-oblongis, oblongisve, acuminatis, in rhachi alata decurrentibus; pinnulis cuneato-obovatis s. oblongis, irregulariter incisis, sinubus obtusis; lacinlis furcatis, laciniulis lineari-oblongis, integerrimis, apice subdenticulatis; sterilibus retusis emarginatisve, inferioribus sorophoris; involucris basi brevi, subcuneata immersis, labiis magnis, liberis, ovato-acuminatis, obtusis, margine serrulato-laceris; receptaculo cylindrico; immerso; rhachibus flexuosis, alatis; stipite brevi, filiformi,

scabro; caudice filiformi, subramoso, repente, sparsim minutissime paleaceo, radiculoso.—KUNZE, loc. cit.

The first citation is a number *74;* the second is *Zollinger 363;* of old collections, I have seen *Zollinger 45, 57,* and *363,* and *v. Gesker* in Herb. Zollinger, from Mounts Salak and Gedeh. The description by van den Bosch, based mostly on the same collections, is much better.

Stipe commonly 5 cm long, firm, with an attenuate wing half or two-thirds of the way down; frond 10 to 18 cm long, 4 to 7 cm wide, tripinnatifid in ample forms, all axes winged; pinnae very oblique at base, ovate or narrower, acuminate, usually not imbricate; all divisions divaricate, with rounded sinuses, the frond therefore distinctly lax in appearance; margin entire except that the apices of sterile segments, when not notched, are often minutely toothed; cell walls uniformly thin: sori very abundant, on any or almost all segments, winged only at the very base, where the fertile segment is sometimes constricted; involucre narrowly ovate or narrower, sometimes broad at the base, cleft to the very short wing, valves minutely and irregularly toothed in the upper part, the apex usually narrowly rounded, sometimes acute or apiculate; receptacle narrowly cylindrical with conspicuous sporangiophores. The sinuses are not merely broadly rounded, but also usually overfull, the margin thereby depressed out of the plane of the frond.

This is one of the best defined Malayan species, and is so unlike the *H. demissum* of New Zealand that their confusion is inexplicable.

JAVA, many collections. SUMATRA, *Korthals, Waitz, Lorzing 6770, Winkler 162.* BORNEO, *Korthals, Clemens 28228, 40900.* LUZON, Laguna Province, San Antonio, *Bur. Sci. 12080 Ramos:* Tayabas Province, Mount Pular, *Bur. Sci. 19304 Ramos.* CATANDUANES, *Bur. Sci. 30886, 30571 Ramos.* NEGROS, *Elmer 10426.*

75a. HYMENOPHYLLUM TODJAMBUENSE C. Kjellb.

Hymenophyllum todjambuense G. KJELLB., Bot. Jahrb. 66 (1933) 41.

Nr. 3505, Todjamboe 1000 m, Epiphytisch im Regenwald [Celebes].

Rhizoma filiforme, nudum. Stipites 2–3 cm longi, circ. ± 2 cm distantes, non alati. Folia lanceolata, ± 10 cm longa 2 cm lata, luteo-viridia, utrinque ad 8-nim pinnata; pinnulae 3–4, apice emarginatae; earum breviores apice soriferae. Rhachis alata, ala sursum dilatata. Venae secundariae fuscae, sinum apicalem haud attingentes. Indusium ovale. Cellulae folii hexangulae.

Diese Art steht *H. productum* Kze. nahe, unterscheidet sich aber durch die weniger verzweigten Pinnae, spärlicheren Sori, den nicht geflügelten Stipes und das Indusium.

76. HYMENOPHYLLUM REINWARDTII van den Bosch. Plate 65.

Hymenophyllum Reinwardtii VAN DEN BOSCH, Plant. Jungh. 1 (1856) 567 (not seen), Synopsis 59; Hymen. Javan. (1861) 52, *pl. 42*.

Hymenophyllum dichotomum BLUME, Enum. (1828) 222, non Cavanilles.

Hymenophyllum australe CHRIST, Philip. Journ. Sci. § C 2 (1907) 156; COPELAND, Elmer's Leaflets 3 (1910) 800, non Willd.

Hymenophyllum australe var. *elongata* ROSENSTOCK, in Herb. Lugd.-Bot., *Koorders 17028*.

Hymenophyllum Copelandianum v. A. VAN ROSENBERGH, Bull. Jard. Bot. Buitenzorg II No. 7 (1912) 19.

Fronde olivaceo-viridi lanceolata vel ovata apice producta tripinnatifida, laciniis patulis vel divergenti-deflexis, fertilibus remotiusculis, ovatis plus minusve elongato-acuminatis, lacinulis elongatis undulato-crispis sinuato-denticulatis, e cellulis diaphano-hyalinis sub-elongatis obtusangulis laete viridibus contexta, soris in lacinulis abbreviatis lateralibus vel subaxillaribus magnis suborbicularibus compressis ad basin breviter alatam usque bilobis, lobis denticulatis, receptaculo indusium dimidium aequante, rhachide stipiteque frondem longitudine aequante, excepta basi, ala latiuscula undulata denticulata marginatis.

Hab. in sylvis elatioribus insulae Tidore Moluccarum, *Reinwardt*; Java? Herb. Reg. L. B.—VAN DEN BOSCH, Hymen. Javan.

The description and illustration of this species by van den Bosch are below his standard. The Herbarium Lugduno-Batavum contains three sheets collected by Reinwardt in Tidore and two purporting to be from Java, all from Blume's herbarium. They are so perfectly alike that I concur in the suspicion of van den Bosch they are one collection.

Rhizome 0.7 mm thick, brown, woody, naked in age; stipe 10 cm long, 1 mm thick, winged except near the base; stipe and rachis scurfy with fine, appressed, sometimes deciduous pubescence; frond 15 cm long, ovate, subquadripinnatifid; all axes bearing crisped wings, major ones 1.5 mm wide, overall; segments 0.7 mm wide, 2 to 3 mm long; margin everywhere inconspicuously serrulate; walls all thin, slightly wavy; fertile segments usually somewhat contracted; involucre more or less orbicular, 1 to 1.2 mm wide, cleft to the base, lips entire or sometimes wavy or obscurely toothed, receptacle with columnar sterile base reaching to middle of involucre and a very slightly enlarged head on and around which the sporangia are densely borne.

Specimens: SUMATRA, *Bünnemeyer 9762, 9826*. JAVA, doubtful. TIDORE, type collections by *Reinwardt* in 1821. CELEBES, *Koorders 17028*. MINDANAO, *DeVore and Hoover 324, Copeland 1024, 1441, Williams 2490 bis, Elmer 11799* (type of *H. copelandianum*). LUZON, *Copeland 1873* (as to which, *i. a.*, Christ wrote of *H. australe*: "The Philippine form has very narrow

segments and is very compound, quadripinnatifid. Under the lens the margins are very finely denticulate."), *F. B. 16317, Bur. Sci. 44916, 44918, 48568, Topping 1139, 1147.* Reported from Dutch Borneo, from which I have seen no specimen; and from New Guinea. As to the latter, *Lam 1782* (sterile) seems misdetermined as this species. *King 210* is possibly *H. Reinwardtii*, but is distinctly smaller (7.5 cm long), and much more crisped, and more spiny, Philip. Journ. Sci. § C 6 (1911) 69.

The Tidore and Mindanao specimens are quite alike; those from Luzon and Sumatra inconsiderably different. A specimen from Leyte, *Bur. Sci. 14481*, is fairly intermediate between *H. Reinwardtii* and *H. fimbriatum*.

77. HYMENOPHYLLUM THUIDIUM Harrington. Plate 36.

Hymenophyllum thuidium HARRINGTON, Journ. Linn. Soc. Bot. 16 (1877) 25; CHRIST, Philip. Journ. Sci. § C 2 (1907) 154.

Hymenophyllum physocarpum CHRIST, in Schum. and Laut., Nachtr. Fl. deut. Schutzgeb. (1905) 35, *pl. 1.*

Stipe slender, 1–3 inches high, winged, (frond) from 2–5 in. long, 1–2 in. broad, ovate to oblong, tri- or quadripinnate, erect; rachis and branches winged like the stipe; pinnae 1 in. long or less, deltoid; wing and ultimate divisions of lamina finely crisped throuout; surface glabrous; sori few to many on the upper part of the frond, at the ends of the ultimate divisions, large; involucre divided nearly to the base; valves large, ovate, crisped.

Mountains of Panay, Philippines, growing thickly on the trunks of trees.

The finely crisped wing and margin of the pinnae give the plant a resemblance to some of the mosses; hence the name assigned to it. The margins are sometimes denticulate; and exceptionally pubescence is present. The plant has affinity with *H. tortuosum*, Hooker; but is nearer *H. crispum*, H. B. K.—HARRINGTON, loc. cit.

There are cotypes in U. S. Nat. Herb. and Gray Herb., and I have a type fragment from the University of Michigan. MINDANAO, *Copeland 1731* from San Ramon, Zamboanga, is almost typical; *Bur. Sci. 39080* from Bukidnon, central Mindanao, is somewhat less crisped, thus approaching *H. Reinwardtii*. NEW GUINEA, *Rosenstock Fil. novoguin., exsicc. 206. l. Bamler.*

The involucre is 1 to 1.4 mm wide, more than twice the width of the segments. The lips of the type vary from entire to obscurely toothed. They are more toothed on the San Ramon specimen, approximately entire on the Bukidnon one. The receptacle is as in *H. Reinwardtii*, with sterile columnar base and slightly enlarged head bearing a compact compressed globe of sporangia—compressed by the valves. The stipe is winged to the base or nearly so. It and the lower part of the rachis may

be 1 mm wide, overall. The minor axes and segments are a scant 0.5 mm wide. The crisping is so intense that careful examination is required to show that, besides the apparent teeth due to the crisping, the margin is really somewhat dentate.

Hymenophyllum physocarpum is represented in Herb. Univ. Calif. by the Bamler collection already cited (the type was collected by Schlechter), which conforms perfectly to Christ's description. It is hardly as closely crisped as the type of *H. thuidium*, but conforms perfectly to Mindanao specimens. The resemblance to *H. subinifolium*, with which Christ compared it, is superficial.

Closely related to *H. Reinwardtii;* distinguished by the much more intense crispiness and narrower segments.

78a. HYMENOPHYLLUM BISMARCKIANUM Christ.

Hymenophyllum Bismarckianum CHRIST, in Schum. and Laut., Nachtr. Fl. deut. Schutzgeb. in der Südsee (1905) 34.

A H. denticulato Sw. differt magnitudine triplo majori, soris non axillaribus sed terminalibus in lobis pinnularum, rotundatis, minutis, atrofuscis, valvis integris, haud spinosis.

Kaiser-Wilhelmsland: Bismarck-Gebirge, 1800 m. ü. M. (Schlechter n. 14030, im Januar 1902).—CHRIST, loc. cit.

Bamler 230a in Herb. Univ. Calif. bears this name, but is so unlike anything this description suggests that I suspect misplacing of label rather than error in identification. Christ, Philip. Journ. Sci. § C 2 (1907) 154, compares this with *H. thuidium*, apparently suggesting that they are identical. I would rather expect it to be *H. Reinwardtii*, except for the entire valves.

78. HYMENOPHYLLUM SAMOENSE Baker. Plate 37.

Hymenophyllum samoense BAKER, Journ. of Bot. (1876) 10; CHRIST, Engler's Jahrb. 23 (1896) 338.

H. shirleyanum DOMIN, Bibl. Bot. 20 fasc. 85 (1913) 22, pl. 1, fig. 1, *pl. 2, fig. 1.*

Hymenophyllum australe COPELAND, Bishop Mus. Bull. 59 (1929) 29, *non* Willd.

Hymenophyllum fucoides CHRIST, Engler's Jahrb. 23 (1896) 337, *non* Swartz.

Rhizome wide-creeping, 0.5 mm thick, brown, glabrescent; stipe about 5 cm long, winged almost to the base; frond about 10 cm long, ovate, naked, tripinnatifid with some segments again forked, rachis narrowly winged with a plane or slightly crisped entire wing, segments 5 to 8 mm long, 1 mm wide, obscurely serrulate or in considerable part entire; cell walls uniformly thin, straight or curved, the marginal teeth usually of

a single cell, at most two cells wide; sori axial to subterminal on somewhat shortened segments, involucre cleft practically to the base, lips irregularly denticulate, receptacle included.

Specimens: SAMOA, *Whitmee* (cotype in Gray Herb.) *Vaupel 59, 449,* in U. S. Nat. Herb. FIJI, *Gillespie 5125.* QUEENSLAND, *Brass 2309.*

In spite of the serrulate margin this is a *Sphaerocionium,* as the term is now applied by Christensen, not a *Leptocionium.* The teeth are even less conspicuous than on *H. Reinwardtii.* The affinity is to *H. javanicum.*

The Fiji specimen which serves me for illustration, the drawings made while it was mistaken for new, is identical with the *Whitmee* cotype. There is another Samoan specimen, *Reinecke 160,* in U. S. Nat. Herb., determined by Christ, Engler's Jahrb. 23 (1896) 337, as *H. fucoides* Sw., described from Jamaica, and except for this collection known from the American Tropics only. Contrary to Christ's judgment, I do not find it quite like the American plant; it is very obscurely serrulate, while *H. fucoides* is conspicuously so. The two do agree in wall structure, the thin internal walls being inconspicuously toothed at the surface. To the naked eye it seems to me to be *H. samoense,* to which I refer it in spite of the walls.

There is no original material of *H. Shirleyanum* in the Queensland Herbarium, but Mr. White sends me *Brass 2309,* so identified by Mr. Everest. The identification is evidently correct, and the plant is perfectly typical *H. samoense.*

19. HYMENOPHYLLUM EMARGINATUM Swartz. Plate 29.

Hymenophyllum emarginatum SWARTZ, Schrad. Journ. 1800[2] (1801) 101 (not seen); Synopsis 148, 377.

Hymenophyllum eximium KUNZE, Bot. Zeit. 4 (1846) 478; VAN DEN BOSCH, Hymen. Javan. 57, *pl. 46.*

Hymenophyllum leptodictyon C. MÜLLER, Bot. Zeit. (1854) 734 (?).

Hymenophyllum inclinatum VAN DEN BOSCH, Plant. Junghuhn. (1856) 570.

Hymenophyllum madeatum VAN DEN BOSCH, Ned. Kruid. Arch. 5[1] (1863) 163.

Hymenophyllum demissum auct. plur. partim, non Swartz.

Hymenophyllum dilatatum auct. plur. partim, non Swartz.

H. emarginatum frond. dichotome sub-3-pinnatis oblongis, pinnis decurrentibus, pinnulis bipartitis, lacinulis linearibus emarginatis, terminalibus elongatis, soris supraaxillaribus. Java.—SWARTZ, Synopsis 148.

Habitat in montibus Javae. Thunberg.

Surculi longissimi, teretes, nudi radicantes radiculis filiformibus longis villosis fuscis.

Stipites teretes, glabri, stricti, 2–3 pollicares.

Frondes semispithameae, oblongae, subtripinnatae, glabrae, diaphanae.

Raches marginatae.

Pinnae decurrentes, alternae, laxae.

Pinnulae dichotomae, seu bipartitae.

Laciniae latiusculae, lineares obtusae apice emarginatae; terminales 2–3-plo-longiores; omnes margine interrimae.

Sori terminales in lacinilis brevioribus versus apicem frondis globosi. *Columella* inclusa.

Valvulae indusiorum subrotundae, majusculae, erectae, conniventes.

Observatio.

Species inter majores numeranda, lacinilis terminalibus elongatis notabilis.—SWARTZ, Synopsis 377.

A painstaking effort to fix the identity of *H. emarginatum* by means of Swartz's description and of rich Javan material lead to the conclusion that it might be (using usual names) *H. formosum*, *H. eximium*, or *H. Junghuhnii*, and was most probably the first. However, subsequent receipt of a type fragment, from Stockholm, fixed it with absolute certainty as the plant best known as *H. eximium*.

This species was very perfectly described and illustrated from fully fruiting material in Hymenophyllaceae Javanicae, where van den Bosch notes that both *H. eximium* and *H. leptodictyon* were based originally on poor specimens. Of the latter, what may represent the type in the Leyden Herbarium is this species, but another specimen so named seems to me rather to be *H. imbricatum*.

Distinguished from *H. imbricatum* by the rachis, terete or at most narrowly marginate in the lower part, the clavate receptacle, and the usually narrower involucre with erose lip margins. The valves are inconstant in form, most commonly more or less truncate.

Hymenophyllum modestum was described from a single, and evidently not too mature or well-developed specimen, *Cuming 212*, as represented in the Berlin Herbarium. We have good specimens of this collection in the Philippine National Herbarium and the United States National Herbarium. They represent the species common in the Philippine and Malay regions, construed by Presl, Hooker, and many others as *H. demissum* Sw.—which it is not. Van den Bosch emphasized the form of the frond, "basi valde angustata," as a specific character. Our fronds of

the type collection have broad bases, but fronds with reduced lower pinnæ are not rare. The "parietibus . . . marginalibus . . . externe crenulatis" are conspicuous on the type specimen, and not on our cotypes, which at first made me suspect a mixture under the one collection number. But more thorough examination of the cotypes showed a variety of marginal walls—perfectly even and straight, or sinuate-thickened, or crenate or pitted—all on single fronds. Typical *H. modestum* has narrower segments and even more wingless rachis than does typical *H. eximium*, but the two forms intergrade completely in the Philippines.

Common in Java, Sumatra, Borneo, and the Philippines. Philippine specimens are: *Cuming 212* (type of *H. modestum*); *Bur. Sci. 5951, 9807, 14768, 19595, 19680, 19712 bis, 27927, 38589, 38926, 40613, 76536; Merrill 6083*, from Mount Halcon; *F. B. 7957; Topping 1232; Williams 2496; Elmer 9910.*

A New Caledonia specimen received by the Herb. Univ. Calif. from Rosenstock as *Franc 1046 part.* seems to be correctly named as *H. eximium*, but is very far from the range otherwise known.

60. HYMENOPHYLLUM JAVANICUM Sprengel. Plate 59.

Hymenophyllum javanicum SPRENGEL, Syst. Veg. 4 (1827) 132; BLUME, Enum. 222; VAN DEN BOSCH, Hymen. Javan. 50, *pl. 40.*

Hymenophyllum crispum NEES and BLUME, Nova Acta 11 (1823) 128, *pl. 14, fig. 1, non* H. B. K.

Hymenophyllum erosum BLUME, Enum. (1828) 221; VAN DEN BOSCH, Hymen. Javan. 54, *pl. 43.*

Hymenophyllum daedaleum BLUME, Enum. (1828) 226.

Hymenophyllum micranthum VAN DEN BOSCH, Pl. Jungh. 1 (1856) 566; Hymen. Javan. 52, *pl. 41.*

Hymenophyllum fimbriatum VAN DEN BOSCH, Hymen. Javan. 55, *pl. 44, quoad plantam javan., nec J. Sm.*

Hymenophyllum australe auct. recent., partim, non Willd.

H. fronde 3-pinnatifida, foliolis 2-angularibus decurrentibus pinnatifidis, laciniis linearibus obtusis undulatis, receptaculis subrotundis, stipite alato. Java. (H. crispum Nees.)—SPRENGEL, loc. cit.

Rhizome wiry, brown, smooth; branched and intricate; stipe 3 to 5 cm long, winged, like the rachis, with a conspicuous, entire, but undulate or crisped, wing; frond commonly 6 to 10 cm long, 3 to 4 cm wide, tripinnatifid, all axes winged like the rachis but less crisped, pinnules and segments at a rather acute angle, contorted and imbricate with the least loss of water, segments about 1 mm wide, 3 to 5 mm long, straight and flat or undulate, entire, walls uniformly thin, straight or minutely wavy, the margin uniform, or with the individual cells convex; sori

abundant, very variable, most commonly 0.7 mm wide, rarely more than 1 mm, involucre cleft to the base, oblong or oval, the apex truncate, rounded or subacute, lip variously irregular—crenate, dentate, incised, or sublacerate; receptacle short and slender, with inconspicuous sporangiophores. A very common little fern of the mossy forest in Java, where the forms that have been called *H. micranthum*, *H. erosum*, and *H. fimbriatum* occur together and intergrade completely.

The range extends to Ceylon, the Peninsula (*Singap. Field Nos. 18605, 20778*), Borneo, Amboyna (*De Vriese*), Papua (*Schlechter 19724, Keysser 176 p.*), New Caledonia (*Vieillard 2286, Balansa 1636 part., Franc 2003*), Fiji (*Gillespie 3823*), and Australia.

Sumatra specimens identified according to the involucre as *H. javanicum*, *H. erosum*, and *H. micranthum* can no more be distinguished thus than can those from Java; but all are alike somewhat different from Java plants in being more divaricate in branching, and therefore more lax, in appearance more like *H. crispatum*.

Of the species that have been confused with *H. javanicum*, only the Philippine *H. fimbriatum* is a very near relative. It has larger sori, with more lacerate lips, and the branches stand at a wider angle. Neither *H. javanicum* nor *H. fimbriatum* has yet been collected in Mindanao or Palawan. *Hymenophyllum australe* has a secondary marginal row of cells; *H. crispatum*, a capitate receptacle; and both differ in other respects.

From both the Malay Peninsula and Australia I have specimens named *H. javanicum* with a perfectly flat axial wing. None are perfect specimens; I do not know what they are.

10a. HYMENOPHYLLUM HUMBOLDTIANUM Fournier.

Hymenophyllum Humboldtianum FOURNIER, in Ann. Sci. Nat. V 18 (1873) 265.

Fronde 3—4" longa, stipite paulo breviori quam limbus, pilis linearibus brevibus hirto, sub apice marginato, limbo lanceolato obtuso, pinnis 6–7-jugis, imbricatis, ovalibus-obtusis, pinnulis cuneato-obovatis, appressis, imbricatis, nervulis 3-chotomis, lacinulis latis obtusis subaequalibus; soris mediocribus, in dimidia superiore frondis parte lacinulas superiores terminantibus, liberis, rhachi flexuosa marginata, indusio ad basim usque fisso, lubis orbicularibus obsolete denticulatis, columella inclusa.

[New Caledonia.] In monte *Humboldt*, 1150 m., octobri sporigerum (Bal. n. 1638).—FOURNIER, loc. cit.

I have not seen this, and merely guess at its proper position in placing it near *H. javanicum*.

806. HYMENOPHYLLUM PRODUCTOIDES J. W. Moore.

Hymenophyllum productoides J. W. MOORE, Bishop Mus. Bull. 102 (1933) 5.

Rhizoma repens nudum, folia ovato-oblonga glabra valde viridia 10–18 cm. longa 4–6 cm. lata, petiolus 3–4 cm. longus ½ mm. crassus nitidus valde fuscus, praeter ½–1 cm. imum alis crispatis sursum ad 1 mm. latis instructus, rachis similiter alata segmentis crispatis 3 mm. altis in axillis pinnarum instructa, pinnae ad 13 utrinque alternae in lacinias secundarias 1–3 dichotomas pinnatisectae laciniae ultimae oblongo-lineares planae integrae falcatae 2 mm. latae emarginatae, septa cellularum marginalium prominentiis interioribus carentia, sori plures ad laciniarum apices gesti ex lamina liberi, indusium elongato-deltoideum acutiusculum in valvas duas omnino divisum 2½ mm. longum integrum, sporangia plus minusve 445 x 363 μ, sporae circa 46 × 46 μ.

Field number 660, March 5, 1927, altitude 300 meters; on moss-covered branches of trees, ridge, south end of Opon Mountain. Endemic. (Raiatea)

A close relative of Hymenophyllum productum Kunze, of Java, this Raiatean plant differs in the following respects: tips of the indusium not toothed, tissue filling in the angles made by the primary branches of the frond more abundant, wing of the stipe and rachis crisped, not plane, veins of the ultimate segments with more numerous cells and smaller lumens.—MOORE, loc. cit.

After completion of this manuscript, I received by the courtesy of the director of the Bishop Museum sterile fronds and a fertile fragment of this species. The receptacle is cylindric, with inconspicuous sporangiophores. The closest affinity seems to be to *H. javanicum*, from which it is distinguished by broader segments and entire lips.

81. HYMENOPHYLLUM FIMBRIATUM J. Smith. Plate 50.

Hymenophyllum fimbriatum J. SMITH, Hooker's Journ. Bot. 3 (1841) 418 *nomen;* HOOKER, Sp. Fil. 1 (1844) 102, *pl. 36 C;* VAN DEN BOSCH, Hymen. Javan. 55 *quoad plantam philip.*

Hymenophyllum fraternum HARRINGTON, Journ. Linn. Soc. 16 (1877) 26, **non** Presl.

Hymenophyllum Sterri C. CHRISTENSEN, Index (1905) 361, 368.

Hymenophyllum fimbriatum, J. Sm.; fronds erect ovate subacuminate tripinnatifid, the segments simple or bifid linear obtuse entire undulato-crisped especially at the rachis, involucres copious all terminal campanulate free sessile 2-valved to the base, the valves somewhat plaited truncate fimbriato-dentate, stipes winged almost to the very base, the wings much crisped. (Tab. XXXVI. C.)—*J. Sm. Fil. Philipp. l. c. p. 418, name only.*

Hab. Luzon, Cuming, n. 218.—Stipes 2–3 inches; frond 4–5 inches. A good deal resembling *H. Javanicum*, but the fructifications are very different.—HOOKER, loc. cit.

This species is distinguishable from *H. javanicum* in aspect by rather more divaricate branching and less tendency to become

contorted with the least loss of water; in details, by larger sori with more constantly and conspicuously fimbriate lips, and often by an irregularity of the margin, suggestive of *H. Reinwardtii*. It has its range in common with the latter (locally), and is distinguished by broader sori with more dissected lips, noncapitate receptacle, and the absence of marginal teeth visible without a lens; also, in general, it is smaller, relatively (to length) broader, and more crinkled. The distinctions from *H. javanicum* are in degree. If the two were common together they might not be distinguished. The normal sori of *H. fimbriatum* are 1.2 to 1.5 mm wide; of *H. javanicum*, hardly more than half of this. Rarely a sorus up to 1.5 mm wide can be detected on a Javan specimen, but, as noted under that species, I find no significant correlation between size of sorus and dissection of lip. The teeth of the lip of *H. fimbriatum* seem to be quite variable; but, as long, attenuate teeth are deciduous, caution is needed before deciding that they are absent. The internal walls are finely pitted, although only slightly thickened. The different structure shown by van den Bosch, Hymen. Javan. pl. 44, is due to his not having had this species, but *H. javanicum*, as his subject.

Hymenophyllum fraternum Harrington, of which I have a type fragment from the University of Michigan, has very long involucres and exceptionally crisped fronds. It is from the mountains of Panay, where more typical *H. fimbriatum* has since been collected. If further collection reveals a plant that has these peculiarities constantly, its name is *H. Steerei*, but, with one very scanty collection it seems more likely to be merely a variant.

Hymenophyllum fimbriatum is endemic in the northern and central Philippines.

Specimens: *Bur. Sci. 6481, 19596, 19761, 22070, 32405?, 32440, 33837, 40252, 40764, 40766, 42225, 44988, 75698, 75699; Elmer 16186; Loher 14843.*

42. HYMENOPHYLLUM RIUKIUENSE Christ. Plate 41.

Hymenophyllum riu-kiuense Christ, in Ann. Cons. Jard. Bot. Geneve 4 (1900) 208; Nakai, Bot. Mag. Tokyo 40 (1926) 244. *Hymenophyllum liukiuense* Christ, Bull. Boiss. II 1 (1901) 1021.

Archipel des Riu-Kiu: ile Amanic-Oshema, environs de Naze, mars-avril 1896 (Ferrié n. 187).

Planta affinis *Hymenophyllo australi* Spreng. (*H. javanico* Bl.), sed differt fronde angusta, lanceolata, segmentis multo angustioribus, linearibus 1 mm. latis (habitu *Hymenophylli capillacei* Roxb. ex insula San-

tae-Helenae); ala undulata racheos angustiore; rachi haud elastica; soris terminalibus partem superiorem folii occupantibus numerosis multo minoribus, valvis ovalibus denticulatis.—CHRIST, loc. cit.

Representing this species, I have *Faurie 4640*, which I suppose to be a subsequent collection by the discoverer of the species (the published name is Ferrié), from Yakushima, whence Nakai, Bot. Mag. Tokyo 40 (1926) 244, cites a specimen, collector unknown. It looks like a small *H. crispatum* with very narrow wing, but differs in having a columnar instead of a capitate receptacle, the sporangiophores extending down half of its length, instead of being aggregated at the apex. This makes it key out near *H. javanicum*, but I believe its real affinity to be to *H. crispatum*. It has no resemblance to *H. capillaceum*, the frond of which is more lax than that of any species illustrated in this paper.

Stipe 3 cm long, winged at the top; frond 5 to 8 cm long, lanceolate-ovate, bifinnatifid with the larger pinnules once or twice dichotomous, rachis with a narrow, slightly crisped wing, segments about 0.7 mm wide, the wing unchanged in width down to the rachis; cell walls thin, regularly pore-pitted; sori on somewhat shortened and narrowed lateral (not distal) segments, involucre oblong or ovate, 1 mm wide, cleft to the base, the lips irregularly toothed, receptacles short, stout, with prominent sporangiophores on the upper half.

61. HYMENOPHYLLUM CORRUGATUM Christ.

Hymenophyllum corrugatum CHRIST in Bull. Boiss. II 3 (1903) 508, Bull. Géog. Bot. Mans (1906), 101 (var. *elongatum*); CHRISTENSEN, Med. Göteborgs Bot. Trädgård 1 (1924) 50.

Une des espèces les plus délicates, les plus composées et les plus crispées, ressemblant pour le port beaucoup a *H. crispum* H. B. Kth. de l'Amérique tropicale; elle est particuliere pour le stipe renforcé et raide.

Dense caespitosum, rhizomate filiformi ramosissimo intertexto, stipitibus remotis rigidis erectis flexuosis atropurpureis glabratis supra cum rachi incrassatis angustissime alato-marginatis 2½ ad 5 cm. longis. Lamina 2 ad 3 cm. longa rarius longiore, deltoideo-ovata, tripinnatifida pinnis 8 ad 10 utroque racheos latere patentibus sive deflexis, confertis ovatis, pinnulis confertissimis iterum pinnatis laciniis ultimis numerosis saepe palmatis 2 ad 3 mm. longis vix 1 mm. latis lineari-lanceolatis saepe cuneatis obtusiusculis, omnibus partibus frondosis valde crispato-undulatis, marginibus integris, glabratis, obscure brunneis; urceolis numerosis 1 mm. longis terminalibus valvis rotundato-ovatis saepe suborbicularibus margine integris receptaculo incluso.

C'est une miniature du type *H. austrole* Sprengel; tres curieux pour la région subalpine d'un pays extra-tropical. La fronde forme une masse compacte de segments crispés et entrecroisés.

Hab. W. China Chang Yang. Wet rocks 6800'. [*Wilson*] *25.*—CHRIST, Bull. Boiss.

Var. *elongatum* n. var.

A type humili et late ovato differt fronde longius stipitata valde elongata ramosissima, ultra 30 cent. longa. [Wilson] 5271, 5271."

—CHRIST, Bull. Geog. Bot.

My only specimen is *Faber 1079*, identified by Christensen, loc. cit., as the variety *elongatum*. The specimen in U. S. Nat. Herb. received as *H. polyanthos*, has fronds from 3.5 to 13 cm long, showing that the "variety" is the species in full development.

Stipe finely filiform; rachis broadly winged, the wing flat next to the axis, the margins strongly crisped; pinnæ slender, and irregular in length; pinnules and segments crisped and contorted as a whole; structure and fructification as in *H. polyanthos*. The fine and densely crisped minor divisions of the frond seem to make this a more than sufficiently distinct local species.

West China, our specimen from Sze Chuen.

31. HYMENOPHYLLUM FLABELLATUM La Billardière. Plate 62.

Hymenophyllum flabellatum LA BILLARDIÈRE, Nov. Holl. Pl. Sp. 2 (1806) 101, pl. *250, fig. 1.*

Hymenophyllum nitens R. BROWN, Prod. Fl. N. Holl. (1810) 159; HOOKER and GREVILLE, Ic. Fil., pl. 157.

Hymenophyllum Hookeri BORY, in Délanger, Voyage, Bot. 2 (1833) 84.

Hymenophyllum frondibus pinnatis, ovatis, acutis, pinnis conformibus, subbipinnatifidis, superioribus decurrentibus, lacinulis obtusis, integris bifidisve; indusiis ovatis.

Filix e surculo repente, tomentoso ut radiculæ aut nudo, vix sesquipalmaris. Frons plana, ovata, acuta, sordide purpurascens, membranacea, diaphana, pinnata, pinnis ovatis, acutis, ovatove-lanceolatis, subbipinnatifidis, oppositis aut alternis, superioribus in rachim teretem decurrentibus, lacinulis oblongis, obtusis, integris aut bifidis; stipite filiformi, frondis longitudine, infra subtomentoso. Sori pinnarum lacinulas sparsim terminantes, solitarii aut geminati, ovales; columnula frugifera elliptico-oblonga, inclusa; indusiis ovatis, bivalvibus, integerrimis, lacinularum latitudine; capsulis subimbricatis, sessilibus; semilibus ovatis.

Habitat in capite Van-Diemen.—LA BILLARDIÈRE, loc. cit.

Rhizome wide-creeping, 0.5 mm thick, light brown, clothed with long tawny hairs which are likely to be persistent at the nodes, stipes very slender, deciduously hairy, commonly 4 to 8 cm long; frond rather longer than stipe, lanceolate to ovate, broadest at base, small forms often deltoid, tripinnatifid at base, rachis terete below, winged above; lower pinnæ (or all) broad on both sides at base, usually acuminate, lower pinnules large,

pseudoflabellate; segments linear, 4 to 15 mm long, entire; cell walls under low magnification thick and straight, highly magnified and with accurate focus deeply wavy,[2] marginal walls thin; sori on shorter lateral segments on any part of the frond, as wide as the segments or wider, winged at the base, or halfway up, involucre cleft to the wing, firm in texture, lips semiorbicular, entire; receptacle slender, long, but all sporangia usually included, sporangia sessile or nearly so.

Exceedingly variable. The hairiness seems to be more persistent in New Zealand and Polynesia than in Tasmania and Australia. Great variability in size, dissection, shape, compactness, shape of pinnæ, and width of segments is known in every land from which we have many collections. A *Hooker* collection from New Zealand, *Herb. Lugd.-Bat. 908, 282–423*, has several sori on a frond 17 mm long, stipe included. Such a frond has no terete rachis, the single pinnæ are shallowly pedately incised, and most segments are wider than long. Less extremely reduced deltoid, compact forms, 3 to 5 cm long, represent *H. Hookeri*. At the other extreme, the fronds become exceedingly lax, and up to at least 30 cm long; and the unequal prolongation of the ends of the pinnæ may make the shape quite indefinite.

Range: VICTORIA and NEW SOUTH WALES, apparently common, *Belche, Boorman, Edward, v. Müller, Toepffer*. SOUTHEAST QUEENSLAND, *Shirley, White*. TASMANIA, *La Billardière*, type fragment, *Herb. Lugd.-Bat. sub No. 910.28–92*, complete, *No. 908.282–439, Archer, Gunn, Hooker, Kerschner, Ball, Tenison-Woods, Shirley*. NEW ZEALAND, many collectors. LORD AUCKLAND GROUP. FIJI, *Brackenridge*. SAMOA, *Vaupel*. TAHITI, *Grant 4402*. The Fiji specimen is correctly named, but I mistrust its origin; the Wilkes Expedition collected this species in New Zealand also. In publishing the name *H. Hookeri*, Bory stated that Bélanger found this fern in Java, quite surely a mistake.

88. HYMENOPHYLLUM RUFESCENS Kirk.

Hymenophyllum rufescens KIRK, Trans. New Zealand Inst. 11 (1879) 457, *pl. 19A*; HOLLOWAY, Trans. N. Z. Inst. 54 (1923) *pl. 65*.

Rhizome creeping slender; stipes, costa and veins when young sparingly clothed with deciduous curved hairs; stipes, very slender, 1–2 inches long, longer than the frond; frond 1–1½ inches long, deltoid, sometimes cuneate at the base, pinnate, rachis winged above the second pair of pinnæ; pin-

[2] For a thorough study of the structure of these walls see Mettenius, Hymenophyllaceae 452, pl. 2, figs. 20–24.

nae twice pinnatifid, unequally rhomboid, the lowest pair divided nearly to the mid-rib; the basal pinnules spreading; capsules, terminal, small, half immersed, divided nearly to the base, hairy when young, margins entire or erose.

Hab: North Island—near the source of the Orua, Ruahine Mountains; 2,000 to 3,000 feet, *H. Field*, Junr.] South Island—Okarito, *A. Hamilton*.

The stipes, rachis, costa, veins and involucres are usually hairy, at least when young; but hairs are rarely produced from the surface of the frond; in *H. aeruginosum* they are developed from both surfaces, and from the margins of the frond as well as from the veins; they are usually straight, and never deciduous as in our plant, my oldest specimens of which have very few hairs. The valves of the capsule are minutely erose in my young specimens from the Ruahine mountains, but this character is not developed in the mature specimens from Okarito.—KIRK, loc. cit.

Represented in Herb. Univ. Calif. by a specimen from Westland Hill Forests, *l. et det. J. Holloway;* in U. S. Nat. Herb. by collections by *Brame*, from Westland, and *Cheeseman*, from Te Aroha Mountain, North Island.

On most of the fronds in hand, only a single basal pair of pinnæ is free (with terete rachis above it). The pubescence is variable in density and persistence, the *Holloway* specimen being most hairy. All hairs, I believe, spring from the axes. They consist of an indefinite number of long cells, reach a length of several millimeters, and, being weak and tangled, are easily broken off. The laminar cells are moderately elongate, and are commonly placed in series, parallel at their bases to the veins and then diverging toward the margin. The walls are thick, with a distinct middle lamella in optical section, sinuate-crenate or somewhat irregularly coarsely pitted where they come to the surface. I find the same variability of lips described by Kirk—round and entire, or somewhat elongate and retuse or obscurely lobed.

This species is clearly related to *H. flabellatum*, as stated by Kirk, but has no affinity to the other species, with stellate hairs, with which he compared it. The hairs on the veins of *H. rufescens* are like those on the rhizome of *H. flagellatum*. It may be regarded as a species cognate with *H. Le Ratii*, like it in form of frond and thickening of walls; but that species is glabrous and has long entire lips.

Endemic in New Zealand.

88. HYMENOPHYLLUM LE RATII Rosenstock. Plate 83.

Hymenophyllum Le Ratii ROSENSTOCK, in Fedde's Repert. 9 (1910) 71.

Hymenophyllum; rhizomate repente, filiformi, ramoso, pilis longis, sericeis, albido-flavescentibus vestito, folia subdistantia ferente; stipitibus

0,5–2 cm vel ultra longis, validiusculis, setiformibus, teretibus, atrobrunneis, pilosis; laminis 2–3 cm longis, 1½–2 cm latis, e basi cordata ovalibus, rubro-fuscis, firmis, subopacis, subpinnato-pinnatifidis; pinnis subcontiguis, basalibus horizontalibus, obovatis, 1 cm fere longis, ½ cm latis, subflabellato-pinnatifidis, plerumque 3-5-lobis, sequentibus 1–2 jugis erecto-patentibus, ceterum cum basalibus subconformibus et subaequalibus, superioribus furcatis vel simplicibus, erectis; segmentis ad 3 mm longis, 2 mm latis, linearibus sterilibus apice rotundatis, integris vel emarginatis, fertilibus in soros attenuatis; rhachibus strictis, ala versus basin evanescente marginatis, infra pilis mollibus, flaccidis, simplicibus, rarius stellatis, vestitis, cum costis venulisque atrofuscis; soris angustis; apicibus laciniarum immersis; indusio e basi conica producto, ad ⅓ fere biloho, lobis angustatis, acutis, integris; receptaculo incluso.

Nova Caledonia: In monte Panié; I. 1910, *I. Le Rat. no. 15.*

Steht dem *Hymenophyllum imbricatum* Colenso aus Neu Seeland sehr nahe, von dem es durch derbere Textur, rotbraune Färbung, weniger dichte Segmentstellung und schmälere, spitze Indusien verschieden ist.

—ROSENSTOCK, loc. cit.

This species is represented by a cotype in the U. S. Nat. Herb., and in all the herbaria at hand by an ample collection by Franc, January 31, 1911, variously distributed as *Franc 1444 and 1446*, and *Rosenstock, Fil. Nov. Caled., Exsic. 64*, the last incorrectly marked "n. spec." The material is uniform and distinct. It is a well-marked species, of the group of *H. flabellatum* and a near relative of *H. rufescens*, from which it is distinguished by nakedness and by the form of the lips. From all forms of *H. rarum* it is distinguished by the deltoid to ovate fronds, usually less than 3 cm long. The internal cell walls are thick, and sinuate-crenate or crenate-pitted where they come to the surface.

This and *H. japonicum* may be exactly alike in size and form, but they are not at all related.

NEW CALEDONIA, on Mount Panié and the plateau of Dogny, as already cited. NEW ZEALAND, *Tilden, South Pacific Plants 290.*

81. HYMENOPHYLLUM RARUM R. Brown. Plate 44.

Hymenophyllum rarum R. BROWN, Fl. N. Holl. (1810) 159; HOLLOWAY, Trans. N. Z. Inst. 54 (1923) *pl. 56.*

Hymenophyllum semibivalve HOOKER and GREVILLE, Ic. Fil. (1829) *pl. 84.*

Hymenophyllum imbricatum COLENSO, Tasm. Journ. 2 (1844) 187, *non* Blume.

Hymenophyllum Gunnii VAN DEN BOSCH, in Baker, Syn. Fil. (1874) 463.

Frondibus bipinnatifidis lanceolatis glabris raris, laciniis margine integerrimis: inferioribus bifidis, involucris terminalibus solitariis, valvis subrotundis. (D.) v. v.—BROWN, loc. cit.

Rhizome and stipes exceedingly slender, dark to black; stipe commonly 3 to 7 cm long, but shorter in dwarfed plants; normal

fronds 6 to 10 (or up to 17) cm long, 14 to 25 mm wide, but reduced specimens common, bipinnatifid, rachis winged throughout or only marginate at the base, segments few, those of ample fronds 2 mm wide, very delicate in texture, sinuses sharp; cell walls thin and straight, the inner side of the marginal wall provided in some places with irregular, incurrent teeth or folds; sori confined to the upper part of the frond, fertile segments usually dilated, sori narrower than the segments, immersed to or beyond the middle, the immersed part bordered by conspicuous branches of the vein, lips rounded, entire, varying from semiorbicular to much wider than long, receptacle very slender, included, sori few. Herbarium specimens have a peculiar persistent odor, which is not that of *H. sanguinolentum*.

Hymenophyllum imbricatum Colenso is a form with short rachis and crowded pinnae. *H. Gunnii* is a form with narrow segments, only as wide as the small sori.

NEW SOUTH WALES, *Boorman, and Watts.* TASMANIA, *Gunn.* NEW ZEALAND, *Hooker, Kirk, Mrs. Armstrong, Ranft, Holloway, Setchell, Brame.*

The presence of very similar plants in South Africa (*H. fumarioides*) and Antarctic America indicates that this is a remnant of an Antarctic flora. Elsewhere, its nearest recognized relative is *H. polyanthos*, broadly construed.

15. HYMENOPHYLLUM INVOLUCRATUM Copeland. Plate 45.

Hymenophyllum involucratum COPELAND, Univ. Calif. Publ. Bot. 12 (1931) 375.

Rhizomate late repente radicoso, stipiteque 3–5 cm. alto sursum alato gracilibus, ca. 0.4 mm. crassis, nudis, fuscis; fronde vulgo 10 cm. longa, 4–6 cm. lata, acuminata, basi angustata, flaccida, atroviride, glabra, tripinnatifida, costa fusca ubique anguste alata; segmentis ultimis sterilibus 0.6–0.9 mm. latis, usque ad 6 mm. longis, integris, apice rotundatis, fertilibus apice dilatatis; soris ad partem superiorem frondis restrictis, ibidem interdum segmenta omnia occupantibus, involucro plerumque obconico, immerso, ca. 1.5 mm. longo et lato, labiis saepius breviter et late rotundatis, interdum fere nullis, rarius longius rotundatis, integris, receptaculo incluso.

Rarotonga, Arorangi; Parks No. 22134, June 3, 1929, "considerable abundance on rocks and trees." Type in Herb. Univ. Calif., No. 392254; also No. 22238.—COPELAND, loc. cit.

Specimens are in all of the herbaria in my hands. A relative of *H. rarum*, distinguished by coarser venation than have similarly ample fronds of the latter, narrower segments which are not conspicuously widened below the sorus, and usually shorter

free valves. In fact the involucre, in shortness of lips, suggests *Microtrichomanes*.

Known from Rarotonga only.

39. HYMENOPHYLLUM WALLERI Maiden and Betche. Plate 56.

Hymenophyllum Walleri MAIDEN and BETCHE, Proc. Linn. Soc. New South Wales 35 (1910) 802.

Rhizome filiform, sparingly hairy with somewhat rufous scaly hairs. Stipes slender, very sparingly scaly-hairy or naked when old, not winged or very narrowly so in the uppermost part, about ½ to 1 inch long. Fronds dark-green, ovate, about 1½ inches long and 1 inch broad, sometimes narrower in the sterile fronds, cut down to the narrowly winged rachis into 5–7 pinnæ on each side. Pinnæ spreading, the lower ones sometimes almost horizontally, ovate to ovate-lanceolate in outline and overlapping each other pinnately lobed rather above half-way to the midrib, the lobes shallowly lobed again; ultimate lobes short and broad, rounded and with quite entire margins. Sori not numerous, terminal on the upper lobes of the uppermost pinnæ; indusium almost orbicular, about one line long and at least as broad, the valves entire or with slightly uneven margins. Receptacle included.

I have for study a specimen of the type collection from Mr. C. T. White.

Rhizome 0.25 mm thick; stipe 0.3 mm thick, 1 to 2 cm tall, terete, pubescent; frond about 3 cm long, 2 cm wide, bifinnatifid with the lower segments (pinnules) forked, rachis and costæ pubescent beneath, naked and prominent above, rachis usually terete above the lowest pinnæ, elsewhere winged; pinnæ mostly imbricate, elliptic, rounded at apex; pinnules imbricate, separated by shallow incisions, cleft shallowly if at all, ultimate segments short, about 1.5 mm wide, rounded, entire; cell walls thin and straight, without dentate thickening except on the inner side of the marginal walls; sori terminating one or a few apical segments, 2 mm long, with a short, immersed tube subtended by widely divaricate branches of the costa, lips large, elliptic-round, entire; receptacle cylindric, more than half as long as the lips.

Known by the type collection, *R. F. Waller*, Evelyn Scrub, North Queensland, November, 1908; and by a suggested var. *orbiculatum* Watt, also once collected, by Watt, at Ravenshoe, North Queensland. This is smaller and rounder, but hardly distinct.

Nearly related to *H. rarum*, from which it differs in form of frond. *H. rarum* is not reported from Queensland.

90. HYMENOPHYLLUM MNIOIDES Baker. Plate 67.

Hymenophyllum mnioides BAKER, Synopsis Fil. (1873) 57.

St. not more than ½ in. l., very slender; *fr.* 1–2 in. l., ¼ in. br., linear, once pinnatifid; *rhachis* winged throughout; the *segm.* all quite simple, linear, the lower ones slightly imbricated, erecto-patent, 2 lin. l., ½ lin. br., the upper ones pressed close to the rachis and much imbricated; *sori* solitary on three or four of the upper segments, large compared with the size of the plant, divided about halfway down, the base campanulate; *valves* more than half a circle, large, membranaceous.

Hab. New Caledonia, Pic du Mont Mu, *Deplanche.*—A minute moss-like plant, with the habit of *Mnium undulatum* or *serratum*, but dark-brown in colour.—BAKER, loc. cit.

Represented by *Franc s. n.*, collected in 1908, summit of Mount Mou (topotype), and *Franc 1457*, collected in 1912, Saint Louis, altitude 500 m.

Fronds commonly 3 to 4 cm long, 6 mm broad; the lower "pinnæ" of most well-developed fronds, and the most of the pinnæ on some, once forked; simple pinnæ 5 mm long, 1.5 mm broad, apex rounded, base broadly decurrent, and the basiscopic side at and above the base often overfull and rolled upward; structure as in *H. rarum*, walls thin, and marginal wall with incurrent teeth in some places; involucre cuneate at base; receptacle slender, included; odor faint. Our specimens bear very few sori.

Endemic in New Caledonia.

A very near relative of *H. rarum*.

91. HYMENOPHYLLUM MONTANUM Kirk. Plate 68.

Hymenophyllum montanum KIRK, in Trans. New Zealand Inst. 10 (1877) 394, *pl. 21B.*

Rhizome slender, wiry, creeping; fronds few, 2–3 inches long, glabrous, linear oblong or oblong lanceolate, bipinnatifid; stipes about 1 inch long, winged nearly to the base; rachis flexuous, winged, pinnæ in from 5–8 pairs, mostly alternate, spreading, about one-third of an inch long, cut nearly to the rachis into 2–4 spreading, linear, forked or bilobate segments. Involucres terminating the segments, small, oval, 2-lipped nearly to the base; lips deeply toothed or jagged; receptacle included.

This interesting addition to our flora was discovered on Mountains at the head of Lake Wakatipu by Mrs. Mason, of Queenstown, to whose kindness I am indebted for specimens. *H. montanum* is distinguished from other New Zealand species by its narrow involucres with deeply toothed or jagged tips; it is of membranous texture and of a dull green hue.

In old specimens the segments are slightly constricted immediately below the base of the involucre.—KIRK, loc. cit.

There is a single specimen, *Kirk 564*, in the United States National Herbarium, topotype, if not a cotype. To Kirk's description, it may be added that the internal walls are thickened and obscurely pitted. The receptacle is like that of *H. rarum*, to which it is more related than to *H. javanicum*, with which Kirk compares it, but from which it differs in having narrow segments and decidedly ragged lips.

New Zealand, apparently very rare.

92. HYMENOPHYLLUM INTRICATUM van den Bosch.

H. intricatum VAN DEN BOSCH, Ned. Kruid. Arch. 5[3] (1863) 168.

Fronde ovata vel ovato-orbiculari bipinnatifida, laciniis primariis e basi erecta mox divergentibus, apice decurvis, late imbricatis e basi latissima cordatis vel rotundatis, secundariis divergentibus imbricatis, lacinulis divaricatis latis leviter undulatis sinu lato interstinctis apice truncatis rotundatisve integris, rhachi valida ala lata undulata marginata, pariter ac venae et venulae, concolori, cellulis firmis subopacis parvis regularibus hexaëdris obtusangulis, parietibus crassis hyalinis, interarcis amorphis parietalibus (spatium oblongum diaphanum relinquentibus) spissis fuscis, globulis passim intersparsis minutis fuscis, marginalibus minimis valde abbreviatis extus convexis, soris majusculis in lacinulis vix abbreviatis terminalibus compressis, indusio ad basin rectam vel rotundato-conicam usque bilobo, lobis subquadratis vel producto-rotundatis repandis, frequenter emarginatis, stipite 15 millim. vix excedente late alato, valido flexuoso. Rhizoma validum intricatum ramosum repens glabrum, frons 2½ centim. circiter longa, 2–2½ lata, firma rigidiuscula membranacea subopaca, laciniis lacinulisque imbricatis undulatisque intricata.

H. Ricciaefolium proxime affine a nostro differt: habitu, forma frondis, directione laciniarum primariarum, inprimis vero indusii forma omnino diversa obovato-pyriformi, fundo dilatato-conico, ad ⅓ usque bilobo, lobis truncatulis crenulatis, etc.

Hab. van. Diemenaland (ad fl. St. Patrick), GUNN (H. HOOK.).

—VAN DEN BOSCH, loc. cit.

I have seen no specimen except van den Bosch's retained portion of the type, more complete than the fragments he usually kept. In general appearance it is a small *H. Humbertii*, but the walls are moderately thickened and pitted and the involucres are larger.

93. HYMENOPHYLLUM FUMARIOIDES Willdenow.

Hymenophyllum fumarioides WILLDENOW, Sp. Plant. 5 (1810) 526.

Hymenophyllum capense SCHRADER, Gött. gel. Anz. (1818) 919, not seen.

Hymenophyllum Thunbergii PRESL, Hymen. (1843) 124, *nomen*.

Hymenophyllum natalense VAN DEN BOSCH, Synopsis (1859) 46.

Hymenophyllum Zeyheri VAN DEN BOSCH, Synopsis (1859) 48, *nomen*.

Hymenophyllum tabulare VAN DEN BOSCH, Synopsis (1859) 57, *sine descr.*

Hymenophyllum Limminghei VAN DEN BOSCH, Ned. Kruid. Arch. 5[e] (1863) 151.

H. frondibus pinnatis, pinnis pinnatifidis, laciniis linearibus obtusis bifidis, soris terminalibus, indusiis retusus, rachi alata, stipite marginato. W.

Hymenophyllum fumarioides. Bory in litt.

Erdrauchartiger Hautfarrn. W.

Habitat in sylvis insulae Mauritii, Borboniae. 4 (v. s.)

Caudex repens filiformis crassitie setae equinae. Stipes sesquipollicaris marginato-anceps. Frons bipollicaris pinnata. Pinnae semi-pollicares pinnatifidae. Laciniae lineares obtusae bifidae. Rachis alata. Sori in apicibus laciniarum. Indusia elliptica apice retusa, vel si mavis levissime emarginata. W.—WILLDENOW, loc. cit.

This is a geographical segregate of *H. rarum*, distinguished only by being more constantly reduced in stature. It is similarly variable, but not known to become as long or lax as the most ample form of *H. rarum*. The two are identical in anatomical detail, and in the remarkable odor, still perceptible in a collection by Ecklon in 1827.

Hymenophyllum Thunbergii was a name used by Ecklon in distribution, printed without description by Presl. The same material was recognized as *H. rarum* by Kunze, and renamed *H. tabulare* by van den Bosch, still without other description than a reference to Kunze's illustration. In his unpublished sketches, *Herb. Lugd.-Bat. 910, 28–69*, van den Bosch shows the dentate inner marginal wall characteristic of *H. blumeanum*, which can be detected in places on specimens from the Cape (*I. Wright*) and from New Zealand (*Setchell*). This one of his "species" van den Bosch ascribed to the group of *H. polyanthos*, placing all the others near *H. rarum*, although *H. Limminghei* is also rather ample, and from as far north as the Comores.

Range: The Cape to the Comores and Mauritius; a Ceylon specimen, *Herb. Lugd.-Bat. 908, 282–671*, ex Herb. Hooker as *H. rarum*, can be that species, but as a matter of distribution would better be called *H. fumarioides*.

93a. HYMENOPHYLLUM PARVUM Christensen.

Hymenophyllum parvum CHRISTENSEN, in Perrier Cat. (1932) 18 *nomen* Dansk Bot. Arkiv. 7 (1932) 8, *pl. 2, figs. 1–3.*

Euhymenophyllum H. raro R. Br. et affinibus colore texturaque valde simile, differt: lamina lanceolata vel oblanceolata, versus basin saepe paulo attenuata, simpliciter profunde pinnatifida vel pinnata, 0.5–3 cm. longa, 4–6 mm. lata; pinnis 4–12-jugis, adscendentibus, saepe imbricatis, omnibus simplicibus, apice subemarginatis, basalibus interdum valde reductis,

maximis 3 mm. longis, 1 mm. vel paulo ultra latis; soris in pinnis superioribus apicalibus, 1–6 in quoque fronde fertili, sat magnis, indusii valvis rotundis, integris.

Mt. Tsaratanana, on tree-trunks, ca. 2000 m. alt. Janv. 1923 (PERRIER 15602, type in Herb. Perrier de la Bâthie), forêt orientale sur la Vohitra près d'Amkatovola, Janv. 1923 (idem 18377), Manankazo (idem 7591), sine loco (GREGORY, Kew).

I venture to describe this small fern as a new species; certainly it is closely related to *H. rarum* R. Br. and its South African representatives (*H. fumarioides* Willd., *H. tabulare* v. d. Bosch), but it differs from all forms of this group known to me by its lanceolate small fronds with invariably simple pinnae; its nearest relative is probably *H. Balfourii* Baker from the Mascarene Islands, but this small fern has deltoid fronds with the lower pinnae forked and a single apical sorus, which is deeply immersed in the lobe.—CHRISTENSEN, Dansk Bot. Arkiv.

The United States National Herbarium contains, from Doctor Christensen, *Perrier 18377*, a tuft of moss containing many minute fronds. Of these, at least four are fertile, bearing one sorus each. On three fronds, one of them only 6 mm long, I find the basal pinnæ forked. A frond of this size is more round than lanceolate, and the forked basal pinnæ may well be responsible for its description as deltoid. The distinctions between *H. parvum* and *H. Balfourii* tend thus to disappear. Moreover, it must be remembered that dwarfs are in general unstable in degree of dwarfing, and, therewith, in form.

The description of *H. Balfourii*, of which I have seen no (other) specimen, follows.

93b. HYMENOPHYLLUM BALFOURII Baker. Plate 69.

Hymenophyllum Balfourii BAKER, Annals Bot. 5 (1891) 192.

Rhizome filiform, wide-creeping. Stipe filiform, very short. Frond deltoid, glabrous, ½–¾ in. long, cut down to a narrow wing into 3–6 erecto-patent lobes, the upper simple, the lower forked. Sorus one to a frond, immersed in the end of a lobe; indusium with a cuneate tube and orbicular lips. Bourbon, *Balfour*. Near the American *H. abruptum*, Hook. —BAKER, loc. cit.

Returning now to the Madagascar plant, *Perrier 18377*: This specimen contains no frond more than 11 mm long. The sorus in every detail, and the microscopic structure, including local incurrent teeth of the marginal wall, are exactly those of *H. fumarioides*. Christensen's description covers fronds up to 3 cm long and with as many as six sori. Such fronds present a degree of dwarfing not at all remarkable in *H. fumarioides*.

My impression is not merely that *H. Balfourii* and *H. parvum* are too much alike, but that both are unfixed dwarf forms of *H. fumarioides*.

Taking this view of *H. parvum*, I can have no other as to *H. compactum* Bonaparte, which I have not seen. By description, it is intermediate between *H. fumarioides* and *H. parvum*.

H. HYMENOPHYLLUM VERONICOIDES Christensen.

Hymenophyllum veronicoides Christensen, in Bonaparte, Notes, Pterid. 12 (1920) 20.

Hymenophyllum remotipinna Bonaparte, Notes Pterid. 15 (1925) 17.

Parva, stipite setiformi, tereti, glabro, atrofusco, 2 cm longo. Lamina lanceolata, 4 cm longa, vix 1 cm basi lata, glabra, fusca, tripinnatifida. Rachi sursum anguste alata. Pinnis 15-jugis, deltoideis, 4–5 mm longis, costa alata; pinnulis inferioribus subpinnatifidis, superioribus furcatis; segmentis ultimis obtusis vel leviter emarginatis, sub 1 mm longis, plus minusve convolutis. Soris ad tertiam partem superiorem frondis aggregatis, 3–4 pro pinna; indusiis duplo vel triplo quam segmento fructifero latioribus, valvis rotundis.

This new species seems to be very distinct. The whole leaf resembles strikingly a fruiting plant of some small annual species of *Veronica*, because the large somewhat inflated indusia are crowded at the upper third of the leaf as are the capsules of *Veronica*. The narrow leafy parts of the segments are rolled over the thick medial vein. The dried plant is of the same characteristic brown colour as *H. fumarioides*.

Madagascar: Région floristique du Centre. Massif de Manongarivo, vers 1400 mètres d'altitude. Bois secs. Au pied des troncs dans les endroits obscures. *H. Perrier de la Bâthie*, n. 7775.

Another specimen, no. 7774, from quite the same locality is no doubt belonging here; it is in size, colour and crowded sori like the type, but the lamina is narrowed downwards and the leafy parts of the segments as well the wing to the rachis are broader and all rolled over the vascular parts.—Christensen, loc. cit.

The United States National Herbarium contains a frond, from Doctor Christensen, of a subsequent collection, *Perrier de la Bâthie 15607*, from Mount Tsaratanana, altitude 2,400 m. It is perfectly typical, 4 cm long, 11 mm wide just above the base. To appreciate the fineness of dissection one must associate these dimensions with the presence of seventeen pairs of pinnæ, the larger of these with seven pairs of pinnules, which in turn may have three or four segments. The broader expanded segments are 0.4 mm wide, but the tendency is to remain rolled in, even when wet. All axes are exceedingly slender. The involucres are up to 1 mm wide, subtended by widely divergent "arms" of the vein, and, as far as seen, perfectly entire. Receptacle filiform, included.

The dried plant has, faintly, the odor as well as the color of *H. fumarioides*. The structure is exactly that of *H. rarum*, even

to the occasional presence of rounded teeth incurrent from the marginal wall.

96. HYMENOPHYLLUM HUMBERTII Christensen.

Hymenophyllum Humbertii CHRISTENSEN, Archives de Bot. 2 (1928) 209, Dansk Bot. Arkiv. 7 (1932) 10, *pl. 2, figs. 6–8.*

Hymenophyllum deltoideum CHRISTENSEN, Dansk Bot. Arkiv. 7 (1932) 10, *pl. 2, figs. 4, 5.*

Rhizomate repente filiforme, subnudo. Stipitibus 1,5 cm. longis, juvenilibus fere ad basin anguste alatis, vetustis exalatis, teretibus, rigidis, cum rachi pilis rufis deciduis superne onustis. Lamina deltoidea vel ovato-deltoidea, 2,5–3 cm. longa, 1,5–2 cm. lata apice rotundata, obscure viridi, tri-quadripinnatifida. Pinnis 3–4-jugis, ovatis, obtusis, segmentis ultimis linearibus vix 1 mm. latis valde crispis; rachibus costisque crispo-alatis. Soris apices segmentorum summorum solum occupantibus, majusculis, quam lacinilis soriferis latioribus, indusiis ovatis, ultra medium bilobis, valvis ovatis, obtusis, integris.

Haute vallée de la Rienana, bassin du Matitanana (Humbert 3351, Typus in Herb. C. Christensen).

Cette nouvelle espèce, par sa petite taille et ses frondes crispées, ressemble à *H. Pollenianum* Rosenstock qui ne m'est connu que par sa description; la fronde ovale-deltoide avec les pennes basales souvent plus grandes ainsi que les stipes et rachis poilus des jeunes feuilles l'en différencie suffisamment.—CHRISTENSEN (1928).

Hymenophyllum deltoideum should be distinguished "by its plane cordate glabrous frond with broader, more divaricating segments." The figures in Dansk Bot. Arkiv. look distinct enough. But Dr. Christensen has provided the U. S. Nat. Herb. with fronds of the type and other known collections of both, and I am unable to regard them otherwise than as one species. Both have broad, deeply cordate fronds. Hairs are deciduous, almost completely on *H. Humbertii*, and *H. deltoideum* is not quite glabrous. The fronds of *H. deltoideum* are slightly crisped; distinctly less so than those of *H. Humbertii*, but the difference is not greater than is common in *H. javanicum*. And the lips of the valves of these fronds of *H. Humbertii* are not entire. *Hymenophyllum Humbertii* was collected at an altitude above 1,000 m, *H. deltoideum* at 300 m; difference in exposure may explain such differences in frond as exist. *Hymenophyllum deltoideum* has broader, more spreading segments, but the difference is within the range of variation of many species, and rounded sinuses are alike on both.

The structure is that of *H. rarum*, and the odor, though faint, is present. Some of the receptacles of *H. deltoideum* protrude

slightly, as the unpublished drawing of van den Bosch shows those of *H. fumarioides*. In spite of the very different shape of frond, they belong in this group.[3]

36a. HYMENOPHYLLUM DELTOIDEUM C. Chr.

Hymenophyllum deltoideum C. Chr. in Pierre Cat. 18, *pl. 2, figs. 4 and 5*; in Dansk Bot. Arkiv. 7 (1932) 10.

Rhizomate filiformi pilis sparsis vestito, cito nudo, late repente; stipite 1.5–2.5 cm. longo, fere ad basin cuneatim alato, subtus pilis rufis sat dense hirto; lamina late cordato-deltoidea, 4–5 cm. longa, basi 3–4 cm. lata, olivacea, glaberrima, triquadripinnatifida, rachi ubique alata; pinnis 5–6-jugis, basalaibus maximis, usque ad 2 cm. longis, deltoideis aequilateralibus anadromice divisis (lamina ita plerumque basi cordata), rarius fertilibus superioribus subdimidiatis, supremis pleromque magis abbreviatis, soriferis, partitionibus omnibus 1 mm. vel paulo ultra latis, planis, marginibus leviter undulatis, lobis ultimis 4–6 mm. longis, obtusis. Soria in lobis superioribus apicalibus, numerosis, basi paulo immersis, quam lobis latioribus, indusiis ultra medium divisis, valvis ovatis, extus rotundatis vel subacutis, levissime crenulatis vel integris, receptaculo parum exsertis.

Bassin du Mangoro, épiphyte vers 300 m. alt. Oct. 1927 (Perrier 18181, type in Herb. C. Chr.).

This new species is best characterized by its short, broadly deltoid and usually cordate fronds; it comes near to *H. tenellum* (Jacq.) Mett., differing by its subentire valves of the indusium and by the shape of the frond; from *H. Humbertii* C. Chr. it differs by its plane cordate glabrous frond with broader, more divaricating segments.—C. Christensen, op. cit., 10.

88. HYMENOPHYLLUM IMBRICATUM Blume. Plates 70 and 71.

Hymenophyllum imbricatum Blume, Enum. (1828) 220.

Hymenophyllum formosum Brackenridge, U. S. Explor. Exped. 16 (1854) 268, *pl. 32, fig. 3*; van den Bosch, Hymen. Javan. 59, *pl. 47, 48*.

Hymenophyllum dilatatum auct. mult. partim, non Swartz.

Hymenophyllum sororium van den Bosch, Synopsis 55, excl. syn. Presl.

Hymenophyllum bamlerianum Rosenstock, Fedde's Repert. 10 (1912) 323.

H. fronde bipinnatifida ovata purpurescente glabra, pinis alternis approximatis rhombeo-oblongis pinnatifidis, lacinlis (s. pinnulis) trapezoideis sursum incisis subimbricatis, lacinulis linearibus obtusis, indusii valvis orbiculatis integerrimis, stipite tereti.

[3] After submission of this manuscript I receive from Doctor Christensen additional material representing these species. To the naked eye, they seem distinct indeed. The more minute resemblances are so complete that I am still inclined to construe the differences as edaphic; but I insert the description of *H. deltoideum* for the sake of completeness.

Obs. Ab. *Hymenophylle sanguinolento*, Sw. differt pinnulis subdimidiatis, sursum modo subpinnatifidis et subimbricatis.

Crescet in Javae montibus locis muscosis.—BLUME, loc. cit.

With recognition of the fact that *H. dilatatum* is endemic in New Zealand, a great number of Malayan and Polynesian collections that have borne this name must be named anew; and the considerable number of published "species" which have in modern use been reduced to *H. dilatatum* present possible substitute names. Among these species, *H. emarginatum* has a wide margin of priority; but examination of type material has shown that it is the species commonly called *H. eximium*.

The next name in point of time is *H. imbricatum* Blume, which has also escaped recognition by the later writers. The Blume specimen in Leyden Herb., a unique, is a small frond, with a single sorus which I do not venture to investigate. It is matched by *267 Horti Bogor., Herb. Lugd.-Bat. 908, 282–193*, identified in the herbarium by Rosenstock as *H. imbricatum*. The Blume specimen has a rather broad wing, this one a narrow one, but both seem to me unquestionably to be small specimens of otherwise typical *H. formosum*. Its receptacle is shown by Plate 70, figs. 5 to 8.

Hymenophyllum formosum is supposed to have a very characteristic receptacle, described as "breve apice capitato," and figured by both Brackenridge and van den Bosch as having a slender sterile base, and a relatively very large spherical head, on which the sporangia are borne on mere traces of pedicels. I have not seen another Tahiti collection which matches these figures closely. Some Philippine specimens do. Most Javan specimens have conspicuous pedicels, inferior in length and size only to those of well developed *H. Junghuhnii*. To test the status of the receptacle, as specifically characteristic in this species, we have examined very many collections and hundreds of sori. The observation as to the pedicels has just been stated. As to form, it varies from globose or moderately depressed and dilated, to broadly or narrowly balloon-shaped or pyriform. Beyond the extreme in one direction is the malleiform receptacle of *H. Junghuhnii*, and in the other the clavate one of *H. eximium*. As a rule, the receptacle is quite uniform in mature sori of any one plant—for an exception, see Plate 70, figs. 5 to 8, from the specimen representing *H. imbricatum*.

Finally I have felt justified in subjecting the type of *H. formosum* to careful study. It consists of two sheets in the United States National Herbarium. One is juvenile. The other, really the type, *No. 57537*, consists of two large fronds attached to a rhizome, and one detached large frond. The former has receptacles with depressed-globose, nearly smooth heads, such as have been figured for the species. The latter has a head which would pass for that of *H. Junghuhnii*—wide, and with very conspicuous sporangiophore branches. It has occurred that specimens of the Wilkes Expedition from different lands were mounted on one sheet; but in this instance the three fronds are so perfectly alike in all other respects that I feel sure they represent one collection; and that *H. formosum* as represented by the type itself bears receptacles of the whole range of forms, except narrower than spherical, of *H. imbricatum*.

Hymenophyllum bamlerianum was based on *Bamler S. 50* and distributed as *Fil. Novoguin. exsic. 207*, which is in Gray Herb. and Herb. Univ. Calif. The former conforms to the description, with fronds less than 7 cm wide, and the stipe with a crisped wing running almost to the base. The Herb. Univ. Calif. specimen has a frond nearly 10 cm wide, and the stipe is wingless practically to the top—as near to typical *H. formosum* as it is to *H. bamlerianum* as described. *Bamler 50*, from the same place, in Herb. Univ. Calif., is still more nearly *H. imbricatum*, well identified by Doctor Rosenstock as "*H. formosum, forma.*" The sorus is that of *H. imbricatum*, not, as described, that of *H. Junghuhnii*. We have illustrated the sorus, including receptacle, of *Bamler 50* and *Bamler S. 50* (at any rate, *Fil. nov.-guin. exsic. 207*), and find the range in receptacles exactly the same as in the type of *H. formosum*. It seems to me that *H. bamlerianum* is an unstable or unfixed local variant of *H. imbricatum*, and that Bamler, with the judgment of a good collector, recognized the various forms as those of one species. The most distinctive feature of the local form is the moderate crisping of the wing, suggesting, as Rosenstock noted (*H. macrocarpum* Presl). *H. badium*.

As usually happens with a species of so wide a range, there are recognizable local forms. Thus, Samoan specimens have practically sessile sori (obsolete fertile segments); while those from the southern Philippines have them on narrow, pedicel-like segments, and the fronds are remarkably large—"formosum," indeed. The material from Java and Tahiti is remarkably alike in appearance.

Range: JAVA, very many collections, mostly named *H. formosum;* among them, *Herb. Lugd.-Bat. No. 908, 281–186,* determined by van den Bosch as *H. leptodictyon* C. Müll., which, according to his text, Hymen. Javan. 58, 59, should be *H. eximium.* PHILIPPINES (Negros, Mindanao), *Merrill 952, Elmer 10205, 11517, Bur. Sci. 14767, DeVore and Hoover 340, Copeland 1012, 1142.* CELEBES, a specimen ex Herb. Waitz, *Herb. Lugd.-Bat. 908, 282–147,* from Mount Klabat, *Koorders 170178.* NEW GUINEA, *Werner 49, Bamler 28, 50.* NEW HEBRIDES, *Kajewski 602, 868.* FIJI, *Seemann 785, Horne 27, Parks 20614, Gillespie 3823.5.* SAMOA, very common. TAHITI, *Brackenridge,* (type of *H. formosum*) *Grant 5326.*

87. HYMENOPHYLLUM TREUBII Raciborski. Plate 72.

Hymenophyllum Treubii RACIBORSKI, Pterid. Buitenzorg (1898) 15, Nat. Tijds. Ned. Ind. 59; *pl. 3.*

Rhizom fadenförmig, kriechend, bis 0.2 m.m. dick nur sehr spärlich mit Haaren besetzt. Blattstiele fadenförmig, bis 0.2 m.m. dick, 2–3 c.m. lang, kahl, unterhalb der Lamina sehr schmal geflügelt. Lamina doppelt gefiedert, durchsichtig, hell grün, im Umriss oval, bis 4 c.m. breit, bis 8 c.m. lang. Rachis jederseits bis 1 m.m. breit geflügelt, gewöhnlich nicht grade aber wellenförmig verlaufend. Die primären Segmente mit ebenso verlaufender Rachis, oberseits mit 1–3 Lacinien, unterseits ohne dieselben, oder mit einen, ausnahmsweise mit zwei Segmenten. Die basalen Segmente gewöhnlich gegabelt, die letzten Enden bis 1 c.m. lang. Alle Lacinien, ebenso wie die Rachis der Segmente 2 m.m. breit, am Rande kahl, ohne Randnerven. Sori rundlich, bis 2 m.m. lang und breit, mit schmaler Basis einzeln an der Spitze der Lacinien sitzend, von zwei rundlichen, bis zur schmalen, graden Basis freien Indusialklappen umgeben. Diese ganzrandig, oder an der Spitze unregelmässig gekerbt.

Ein Epiphyt der bemoosten Baumstämme. In der unteren Waldzone am Süd- und Ostabhang des Salak nicht selten.

—RACIBORSKI, Pterid. Buitenzorg.

Collections by Raciborski from the south slope of Mount Salak, presumably of the type collection, are in Phil. Nat. Herb., Herb. Lugd.-Bat., and Herb. Copeland; *Bakh van den Brink 5879,* in Herb. Lugd.-Bat. and Herb. Univ. Calif., is from the same place and typical. *Hymenophyllum Treubii* var. *novoguinceuse* Ros., Fedde's Repert. 12 (1913) 525, *Keysser 239 p.,* in Herb. Univ. Calif. from Rosenstock, is too typical to need any additional name. Brause, Bot. Jahrb. 56 (1920) 40, reports four Papuan collections by Ledermann, two each of the typical form and the variety. A specimen from Perak, *M. Haniff 2486,* distributed as *H. dilatatum,* is probably *H. Treubii;* the same is true of *Holttum, Singapore f. n. 21596,* as *H. productum.*

To Raciborski's description I have only to add that the walls are thin and uniform, and that the receptacle is broadly clavate, without evident sporangiophores. On all specimens the wing is evident throughout the rachis and part-way down the stipe. The valves are as stated, either entire or somewhat irregular at the apex.

This species may be a reduced form of either *H. emarginatum* or *H. imbricatum*. The width of segments and wing suggests the former; in the sorus, it is more like the latter. The great distance between the Salak (western Java) and the Sattelberg (eastern Papua) suggests an independent origin in the two places, but there is no other evidence to this effect; *H. emarginatum* is known in both places.

98. HYMENOPHYLLUM JUNGHUHNII van den Bosch. Plate 73.

Hymenophyllum Junghuhnii VAN DEN BOSCH, Plant. Jungh. 4 (1856) 570, Hymen. Javan. (1861) 60, *pl. 49*.

Fronde late oblonga vel ovata angustata tripinnatifida, laciniis divergentibus horizontalibusque, apice saepe caudato-productis, e cellulis mediocribus magnisve regularibus fusciduliis contexta, soris terminalibus praemagnis ex orbiculato transversim latioribus subexsertis ima basi marginatis bilobis, lobis integris sorum ⅔ longitudine aequantibus, receptaculo brevi malleiformi, rhachi stipiteque, fronde parum breviore simmo apice, anguste alatis.

Hab. ad truncos arborum in montosis Javae; REINWARDT, BLUME, JUNGHUHN; in m. Tjapoes, Salak et Gedé ZOLLINGER Coll. I N. 1841 a.

Rhizoma validum, filum ferreum crassum, horizontale ramosum glabrum; stipes validus, rhizomate fere crassior, 10–12 centim. longus teres strictus, summo apice anguste alatus; frons usque 1½ decim. longa, 9 centim. lata membranacea firma subopaca olivacea late oblonga vel ovata apice plus minusve angustata elongata tripinnatifida, laciniis primariis inferioribus horizontalibus, superioribus sensim minus divergentibus contiguis leviterve imbricatis e basi obliqua lata ovatis oblongisve acuminatis (nonnumquam apice producto caudatis) bipinnatifidis, secundariis divergentibus vel patulis contiguis rhomboideis vel obcuneatis, exceptis summis 1–2 furcatis simplicibusque, pinnatifidis, tertiariis erecto-strictis, lacinulis late linearibus parum elongatis integris, in sinubus leviter undulatis, apice rotundato-integris; rhachis anguste marginata, alâ integra hic illic leviter undulata venaeque et venulae validae; sinus angusti fundo rotundato-obtuso; sori in laciniis secundariis laterales in lacinula abbreviata subexserti maximi ex orbiculato transverse latiores turgidi, indusio basi recta breviter alata bilobo, lobis integris leviterve repandulis indusium ⅔ longitudine aequantibus, receptaculo brevi apice in capitulum malleiforme incrassato; cellulae parum diaphanae, centro nebulosae mediocres, imo magnae regulares hexagonae subacutangulae, parietibus rectis hyalinis incrassatis, interaneis amorphis diffusis fusciduliis; marginales universe minores.

Tab. XLIX fig. 1 et 2 planta, nat. magn., 3 lacinulae fertiles, 4 steriles, 5 et 6 indusium, 7 et 8 cellulae e margine, 9 et 10 e limbo frondis, 11 et 12 lacinula transversim secta; cuncta magn. auct.

Obs. Hujus loci foret illustratio *H. imbricati* Bl. (*Enum.* II p. 220). Etiamsi, visis speciminibus authenticis Herb. Reg. L. B., illud nunc novi, de specie conservanda valde adhuc dubito. Propterea, meliora forsan postea edocturus, nunc memorasse sufficiat.—VAN DEN BOSCH. Hymen. Javan.

Well characterized in Java by its very large and especially wide involucres and malleiform receptacles, with the sporangia on prominent pedicels. The species is common in western Java, apparently not rare in Sumatra, and reported from Dutch Borneo. Such specimens as I have seen so named from Amboyna and Papua are not this species. *Hymenophyllum longifolium*, described from Celebes, is a near relative, but better kept specifically distinct.

It is only in the Philippines, where *H. ludium* and *H. emarginatum* are present and variable, that *H. Junghuhnii* has been confused with any other species. There are several collections from Negros and Mindanao which have not been questioned in the past as *H. Junghuhnii*, but it seems better now to regard them as *H. emarginatum*.

There is also one collection from eastern Java, *L. Mousset*, but with Winkler's label, *Herb. Lugd.-Bat. 910.122–1480*, which is more like *H. longifolium*. Both rhizome and stipe are filiform, and the largest frond is 50 cm long and hardly 7 cm wide.

In consideration of its name the type of this species should be a *Junghuhn* collection. I have accordingly illustrated it by the best of these in Leyden Herb. *908.282–194*, which may be regarded as the type. We have examined very many receptacles, and reproduce enough to show how uniform they are.

99. HYMENOPHYLLUM LONGIFOLIUM v. A. van Rosenburgh. Plate 74.

Hymenophyllum longifolium v. A. VAN ROSENBURGH, Bull. Jard. Bot. Buitenzorg II No. 16 (1914) 17; COPELAND, Journ. Arnold Arboretum 10 (1929) 175.

Hymenophyllum Junghuhnii KJELLBERG and CHRISTENSEN, Bot. Jahrb. 66 (1933) 40, *non* van den Bosch.

Euhymenophyllum.—Rhizoma repens, gracile, sparse longi-pilosi. Stipites sparsi, ca 3–4 cm longi, glabri, minime in parte superiore alati. Frondes late lineares, tenues, glabrae, ca 40–50 cm longae, 8–9 cm latae, basi angustatae, rachide late alata. Pinnae copiosae, confertae, patentes, arcuato ascendentes, maximae triangulari-lanceolatae, usque ad 5 cm longae et basi oblique truncato-cuneata usque ad 2½ cm latae, rachide late alata. Segmenta secundaria infra segmentum terminale paullo elongatum usque ad 7 utrinque; segmenta superiora simplicia vel furcata; segmentum infimum anticum maximum, triangulari-oblongum, usque ad 1½

cm longum et 1 cm latum, basi postica 1-2-pinnatifidum, antica 2-4-pinnatifidum. Segmenta ultima ca 1½-2 mm lata, sterilia obtusa, apice emarginata, fertilia prope apicem constricta; venae in segmentis ultimis solitariae, apicem segmentorum sterilium non attingentes. Sori ad segmenta ultima terminales; indusium 2-valve, valvis rotundatis vel suboblongis, integerrimis vel sub-integerrimis; receptaculum breve, inclusum.

Celebes (*Mt. Boesoe*, Capt. van Vuuren's Exploration Excursion, Rachmat No. 615).—V. A. VAN ROSENBURGH, loc. cit.

This species was described from Celebes, the description applying satisfactorily to our specimens with the help of its author's English version showing that the stipe is winged *at least* in the upper part; this wing may be a full millimeter wide on each side. It is nearly related to *H. Junghuhnii*, the head of the receptacle widened to fully twice its length. It differs from that species in its very elongate fronds, broader wings on the rachises and costae, and shorter segments, which may be emarginate as described, or rounded. It may be suspected that the *H. dilatatum* reported in New Guinea by Brause (in Bot. Jahrb. LVI. 40 (1920) with very long and narrow fronds, is really this species.—COPELAND, loc. cit.

Rosenstock would reduce this to a variety of *H. Junghuhnii*, but the distinctions noted in the preceding quotation may suffice to justify its specific recognition. While the wing of the rachis of the two collections known is essentially plane, there is a slight overfullness of the lamina of the segments, alike in the two collections, which gives the frond the attractive appearance of a "watered" fabric.

Range: Celebes; Papua; and, I believe East Java, Tengger Mountains, *I. Mousset*, and distributed by Rosenstock, *Fil. Javae Or. n. 90*, and by Winkler.

As the cotype in the Leyden Herbarium is defective, I have illustrated the plant by my own specimen of the Papuan collection, *Brass 1467*, U-uma River headwaters, altitude 1,500 to 2,000 m.

160. HYMENOPHYLLUM SALAKENSE Racib. Pl. 15.

Hymenophyllum salakense RACIBORSKI, Pterid. Buitenzorg (1898) 18.

Rhizom kriechend, fadenförmig, bis 0.3 m.m. dick, spärlich behaart. Blattstiele 4-8 c.m. lang, 1 m.m. dick, von der Basis der Lamina bis zur Anheftungsstelle am Rhizom, oder bis zu einer Entfernung von 1 c.m. vor demselben deutlich geflügelt, die Flügel 1-2 m.m. breit. Lamina dreieckig, von der breiten Basis gegen die Spitze verschmälert, 1-15 c.m. lang, 6-11 c.m. breit, durchscheinend, mit abstehenden, nur wenig nach oben gerichteten Segmenten, doppelt gefiedert mit gelappten Segmenten zweiter Ordnung. Rhachis breit geflügelt, bis 3 m.m. breit, manchmal etwas kraus. Die Lacinien linear, 2 m.m. breit, kahl und ganzrandig. Sori an der Spitze der nicht unterhalb ihrer Anheftung verschmälerten Lacinien, Indusialklappen rundlich, oder ein wenig abgeflacht, 2-3 m.m. breit und lang, ganzrandig, mit flacher nicht nierenförmiger Basis sitzend.

Mit H. Junghuhnii nächst verwandt, doch scharf verschieden, und durch Uebergänge nicht verbunden, von dem mir unbekannten H. Reinwardtii durch ganzrandige Lacinien verschieden.

Auf den bemoosten Baumstämmen am Süd- und West Abhang des Salak, in der mittleren Gebirgszone.—RACIBORSKI, loc. cit.

Raciborski collections, presumably cotypes, are in Leyden Herb. (fertile) and Phil. Nat. Herb. (sterile); topotypes, *Bakh v. d. Brink No. 2617*, are in Leyden Herb. and Herb. Univ. Calif. The former contains also an old Herb. Waitz specimen from Mount Gadang. From Sumatra, approximately typical, are *Ajoeb 512* in Leyden Herb., and *Yates 5630* in Herb. Univ. Calif. Christensen, Mitt. Inst. Bot. Hamburg 7 (1928) 142, reports it from West Borneo. A New Guinea specimen in Leyden Herb. received under this name is very distinct (*H. opacum*).

The plant is smaller than *H. Junghuhnii*, with broader wings and segments, and the sori on distal segments which are not contracted, so that they fall in the outline of the frond, while *H. Junghuhnii* has the terminal segments of pinnæ, and commonly of the pinnules as well, sterile and prolonged beyond the most of the sori, *H. salakense* has more the appearance of *H. badium*. Still, I consider it a reduced, local derivative of *H. Junghuhnii*, and, in spite of Raciborski's statement, would expect to find intermediate forms; in fact, loose fronds with *Herb. Lugd.-Bat. 924, 325–207, l. Bakh van den Brink No. 2609*, from the type locality, seem to be intermediate.

101. HYMENOPHYLLUM BADIUM Hooker and Greville. Plate 76.

Hymenophyllum badium HOOKER and GREVILLE, Ic. Fil. (1828) pl. 76; Sp. Fil. 1: 102, 150; Syn. Fil. 60.
Sphaerocionium badium PRESL, Hymen. (1843) 127.
Hymenophyllum Cumingii VAN DEN BOSCH, Synopsis (1859) 55.
Sphaerocionium macrocarpum, PRESL, Hymen. (1843) 127, 153.
Hymenophyllum macrocarpum VAN DEN BOSCH, Synopsis (1859) 55.
Hymenophyllum latilobum BONAPARTE, Notes Pterid. 13 (1921) 102, teste Tardieu and Christensen, Bull. du Mus. 6 (1934) 287.

Fronde lanceolata bipinnatifida, laciniis lineari-oblongis obtusis integerrimis glabris, inferioribus bifidis, soris raris in lacinia inferiori, involucris rotundatis.

Hab. In India Orientali. *Wallich.*

Caudex repens, filiformis, gracilis, ramosus, intricatus, fibroso-radiculosus.

Stipes etiam filiformis, bi-triuncialis, superne alatus.

Frons, circumscriptione, ovato-lanceolata, 4–5 pollicaris, bipinnatifida, segmentis primariis ovato-lanceolatis, laciniis lineari-oblongis, obtusis vel emarginatis, non raro inferioribus bifidis. *Textura* frondis ex arcolis parvis. *Color*, siccitate, fuscobadius. *Costa* fusca.

Involucra rara, praecipue versus apicem frondium, in lacinia inferiore ad superiorem partem segmentorum, solitaria, terminalia, rotundata, bivalvia, valvis concavis, integerrimis.

Sori inclusi.

Capsulae paucae, breviter pedicellatae, sphaerico-compressae, columellam brevem terminantes, annulo integro, obliquo.

Semina angulata, et ut videtur, ternatim congesta.

—HOOKER and GREVILLE, loc. cit.

This species is hard to typify because it was described from a Wallich specimen without stated origin—"probably from Nepal;" and a different species appeared later in Wallich's list under this name—see Sp. Fil. 102. The Leyden Herbarium contains two defective fronds from "Ind. Or." "Herb. Hooker," which are very probably Wallich collections. In the Synopsis, the specimen cited with positive location is by Sir. W. Norris, from the Malay Peninsula. Beddome cited it (as a variety of *H. javanicum*) from Sikkim, Tenasserim, and the Peninsula. Van den Bosch knew it in 1859 (Synopsis 55), by publication only, and regarded it as distinguished from his *H. Cumingii* by "fronde e basi obtuso elliptica, laciniis primariis previbus, soris in hisce axillaribus solitariis, indusii lobis integerrimis, colore badio, etc." He must have received the specimens already referred to at a later date. These specimens are sparsely fruiting, and therefore unlike well-developed ones in shape and position of sori. I suppose that they came from as far south as Tenasserim, rather than from Nepal.

The Norris collection is represented in the Gray Herbarium and the Leyden Herbarium, and I see no reason to doubt its identity. The type collection of *H. Cumingii*, *Cuming 112*, is represented in the Gray Herbarium, the United States National Herbarium, the Philippine National Herbarium, and my own herbarium, by quite uniform material, which I consider identical with the *Norris* specimen already referred to. As to *Cuming 112* and *130*, the type collection of *Sphaerocionium macrocarpum*, the specimens I have in hand certainly represent one species. Christensen and Ching have identified as this species several Chinese collections of the short form.

Stipe commonly about 5 cm long, rarely exceeding 10 cm, winged in the upper half or throughout, the wing usually broad, sometimes even 2 mm, plane, or sometimes overfull and therefore more or less crisped: frond 6 to 10 cm broad at the base, 10 to 25 cm long, varying from ovate-lanceolate to ovate (common, short form), and to lanceolate (in both the *Norris* specimen and

Cuming 112), obtuse, tripinnatifid, everywhere rather broadly winged and the segments therefore oblong rather than linear, the wing on the rachis sometimes somewhat crisped, apices rounded or slightly emarginate, distal segments never very elongate; cell walls (except marginal) very thick, straight.

The receptacle is interesting and characteristic in its variability. The receptacle is the end of an axis, originally with a growing point like other axes. Elsewhere on the plant, growing points divide, giving rise to dichotomous, eventually monopodial, systems. In most species, any forking of the fertile axis ends (receptacles) is unknown, and in no other is it common. In this species it is common, but varies in the stage at which it occurs. If it is very late in development, the branches do not separate, and the resulting form is that characteristic of *H. junghuhnii*, rare in this species. If it occurs a little earlier, it results in two divaricate or horizontal branches on a common sterile base. There are all stages between simple, broadly club-shaped receptacles—that is, no forking—and those in which the dichotomy is below the sorus and produces twin sori. If it occurs at the base of the sorus, there are two divaricate receptacles; this condition is fairly common. In all cases the sporangia are large and borne on conspicuous pedicels.

The form of the involucre is a function of the branching of the receptacle. If the latter is simple, the involucre is approximately round; this is the usual form on sparsely fruiting fronds (for example, the type). To inclose divided receptacles, the involucres are broader. If there are two receptacles, the involucre is about twice as broad as long, as described in Synopsis Filicum. There are also rare forms, between these and twin sori, with the valves deeply emarginate or cleft. Denticulate involucres, as described in the Synopsis, I cannot find; the margin is usually entire; otherwise, slightly irregular. Below the involucre, the lamina is usually but not always contracted. In full fruit, sori are produced on all or all but the distal segments, on both sides of the pinnae.

Specimens: CHINA, Yunnan, *Henry 11545* (*H. dilatatum* var. *amplum* Christ), *Hancock 218;* Kweichow, Tsiang *6344, 7568;* Kwangsi, *Ching 5752, 5831, 6271, 6975, 7086;* Kwangtung, *Matthew 45, Merrill 10171, 11099, Levine 574, 1469, Levine and McClure 9631; Canton C. C. 12410*, det. C. Chr., veins conspicuous, *14123;* Fukien, *Dunn* (*Hong Kong No. 3911*), *Dalziel.* JAPAN, *Faurie 4699*, and without name of collector in Gray Herb. and U. S. Nat. Herb. FORMOSA, *Faurie, 305, 628*, and, det. Ro-

senstock, *14*, sterile, *285*. INDO-CHINA, *Colani 580, Pételot 3325, 3905, 4061*. PENANG, *Haniff 15106*. PENINSULA, *Kew distribution 105, Norris*. PHILIPPINES, *Cuming 112* (type coll. of *H. Cumingii*) *v. d. B., 130* (type coll. of *Sphaerocionium macrocarpum*); *Bur. Sci. 1804, 3845, 4284, 8383, 13531, 15062, 15263, 17525, 20597, 22072, 23548, 33923, 37588, 38531, 38797, 39188, 41903, 48570, 48653, 48654, 77197, 80347; Loher 1197, 18492; Matthews; Merrill 6079, 6081; Clemens 1081*; thus ranging from northern Luzon to Mindanao, mostly along the eastern side of the Archipelago.

There are a considerable number of other Philippine collections, which have been distributed as *H. Junghuhnii* but which I now feel sure are *H. badium*. The large, very broad involucres of the two species may be exactly alike; and so may the receptacles as regards their dilation and pedicels, but the widened head is on a longer stalk in well-developed *H. Junghuhnii*, and therefore stands higher in the sorus. The latter species is usually a larger, handsomer fern, a clear, deep green in color, likely to have a narrower, and never a crisped wing on the rachis, and with contracted fertile segments, the sorus therefore often appearing stalked.

Luzon specimens which have been called *H. Junghuhnii* are *Bur. Sci. 7190, 8383, 13531; Copeland 1921*, and *P. P. E. 65; Vanoverbergh 869; Topping 1160*. All of these are better referred to *H. badium;* they are brownish, several have somewhat crisped wings, and they agree better with it in form. I refer here also *Bur. Sci. 31914 Santos*, although the narrow wing and the correlated very narrow fertile laciniæ give it a very distinct appearance.

CELEBES: *Bünnemeyer 12079*.

Reported from Mount Kinabalu, Borneo, by Christensen, Gardens' Bull. S. S. 7 (1934) 214, on the strength of a sterile specimen, *Clemens 27315*. *Clemens 20412*, from Sarawak, also all but sterile, is probably this species. *Brooks 158*, Mount Penrissen, Sarawak, with many sori, all immature, seems also to be *H. badium* rather than *H. salakense* (unlike both in having pitted walls), with the stature of the latter but a slightly wavy wing. It may be that *H. badium* shades into *H. salakense* in Borneo; and it may still be expedient to recognize both of them as species.

A specimen from Riouw distributed as *H. formosum, Bünnemeyer 5927*, seems more like *H. badium*, but is intermediate in character as well as geographically. Brause, Engler's Jahrb.

56 (1920) 41, credits *H. macrocarpum* to Papua. It will be observed that I have seen no later specimen from the Himalayas, the supposed source of the type.

At this point must be considered the plants for which van den Bosch prepared, but did not publish, the description of a species to be called "polyanymos." The material was *H. dilatatum* ? Blume, and *Cuming 220*, which was *H. sanguinolentum* J. Sm. *non* Sw., and *H. crispatum* γ, *majus* Hooker, Sp. Fil. 1:105. Van den Bosch stipulated that it was *Cuming 220* in Herb. Hooker *nec alibi*, but the specimen in the Phil. Nat. Herb. is exactly the same. What purports to be the Blume specimen in Herb. Lugd.-Bat. *908, 281–738* bears two separate fronds. The one on the left is sterile, and may be *H. imbricatum*. The one on the right is fertile, and must have been the source of van den Bosch's unpublished figure, showing a deeply divided receptacle. I feel sure that an accident in the Leyden Herbarium is responsible for the presence of this frond on the Blume sheet. The pitting of the walls is characteristic, unlike any known in Java, but identical with that of our specimen of *Cuming 220*, which it surely is.

This collection has the unstable, often more or less forked, receptacle of *H. badium*, but the walls are too characteristically different to permit identification with that species.

For further reference to this plant, see *H. opacum*.

192. HYMENOPHYLLUM CRISPATUM Wallich. Plate 11.

Hymenophyllum crispatum WALLICH, List (1828) No. 169, *nomen*; HOOKER and GREVILLE, Ic. Fil. (1828) *pl. 77*; HOOKER, Spec. Fil. 1: 105; BEDDOME, Ferns S. India, *pl. 207*.

H. javanicum resp. *H. australe auct. plur.*

Erect, fronds ovato-acuminate tripinnatifid, the segments linear obtuse generally plane sometimes waved entire, involucres terminal sometimes on lateral segments copious ovate sessile free entire 2-valved to the very base the valves convex, receptacles wholly included, stipes with broad crisped wings almost to the base, wing of the rachis also crisped.

—HOOKER, Spec. Fil.

Stipe 3 to 5 cm long, winged almost to the base with a broad, crisped wing; frond 6 to 12 cm long, ovate or narrowly so, olive or brownish green, rachis winged, the wing more or less crisped, a slight overfullness usually extending to the laciniæ, which are wavy, bent, or straight, 0.6 to 1.2 mm wide, up to 5 mm long; walls uniformly thin and straight; sori on axillary or lateral contracted segments, involucre 1 to 6 mm wide, ovate to orbicular, cleft to the base, lips entire or erose, receptacle with short,

columnar sterile base, and dilated head with evident or prominent sporangiophores.

Common in the Himalayas from Nepal east; thence south to Ceylon and the Peninsula, where it overlaps the area of *H. javanicum* (from all of India it is useless to cite specimens because so few bear collector's numbers). CHINA, *Hancock 161* (mixed with *H. badium* in U. S. Nat. Herb.), *Henry 10038, Rock 7335.* LUZON, *Bur. Sci. 4556, 5443, 5807, 8511, 31914, Topping 1115, F. B. 5053, Merrill 7663, Philip. Plants 950.*

The near affinity of *H. crispatum* is not to *H. javanicum*, with which it has been confused, but to *H. badium*. When Beddome, Ferns Brit. India and Ceylon 33—not in his earlier works—reduced *H. badium* to a variety of *H. javanicum*, it was because he had already made the less reasonable mistake of merging *H. crispatum* in that species. Compared with *H. badium*, *H. crispatum* is smaller, more crisped, and with narrower wing, segments, and sori.

102a. HYMENOPHYLLUM PLEIOCARPUM v. A. van Rosenburgh. Plate 78.

Hymenophyllum pleiocarpum v. A. VAN ROSENBURGH, Bull. Jard. Buit. III 5 (1922) 208.

Of this plant I have authentic specimens, *Bünnemeyer 9142, 9245,* and *9313;* also *Bartlett 6542;* all from Sumatra. The wing of the rachis is only moderately crisped, and the lips of the involucre are subentire. These distinctions from *H. crispatum* seem too weak to justify specific distinction. Also, if it be held distinct, some of the Luzon specimens will seem to represent it, while others will seem to be *H. crispatum;* but they are surely all one species. Therefore, it seems best to regard *H. pleiocarpum* as a form of *H. crispatum*, perhaps established in Sumatra, but present and not established in Luzon.

103. HYMENOPHYLLUM CRISPATO-ALATUM Hayata. Plate 79.

Hymenophyllum crispato-alatum HAYATA, Ic. Pl. Formosa 5 (1915) 256.

Hymenophyllum javanicum NAKAI, Bot. Mag. Tokyo 40 (1926) 244. non Sprengel.

Rhizoma repens. Stipes 6–10 cm. longus a basi usque ad medium teres a medio sursum alatus cum alis 2 mm. latos, alis ± mm. latis, glaber. Frons ovato-lanceolata vel lanceolata 14–22 cm. longa 3½–6 cm. lata apice acuminata basi in ambitu truncata bipinnatifida, segmentis I. mediis vel inferioribus longissimis, infimis brevioribus superioribus gradatim brevioribus minoribus, mediis oblongis 3 cm. longis 1½ cm. latis apice obtusis basi latissimis latere superiore truncatis latere inferiore cuneatis, segmentis II. infimis mediis obovato-cuneatis apice obtusissimis basi cu-

neatis 8–9 mm. longis 5 mm. latis pinnatis, lobis linearibus apice obtusis 3–4 mm. longis 1 mm. latis; textura tenuissime membranacea glabra semihyalina; rhachis alata, cum alis 2 mm. lata, alis 5 mm. latis valde undulato-crispatis; rhachis segmentorum I. alata cum alis 2 mm. lata, alis partibus inferioribus undulato-crispis; segmentis inferioribus I. a se circ. 1½–2 cm. remotis, segmentis inferioribus II. I. vel II. siti breve stipitati, stipitibus apice constrictis; involucrum perfecte bivalvatum oblongo-rotundatum margine denticulatum.

Hymenophyllum javanicum HAYATA Ic. Pl. Formos. IV. p. 141, fig. 81, (non Sprengel).

Hab. Mt. Arisan, leg. B. HAYATA et S. SASAKI; inter Heishana et Nimandaira, leg. B. HAYATA et TAKEO ITO, Mart. 1914.

Differs from *Hymenophyllum javanicum* Sprengel by the much narrower and longer fronds with sori usually situated at the basal portions of the pinnae. Somewhat allied to *H. crispatum* (Hk. et Grif. t. 77) by the crispate wings of the stipes; but widely different from it by the lanceolate fronds with truncate valves of the involucres.—HAYATA, loc. cit.

Known from Mount Arisan only, whence I have it as *Faurie 627*.

It is like enough to *H. crispatum* in gross aspect to pass easily as that species, and it is only because its internal walls are considerably thickened and closely crenate-toothed that I abstain from reducing it.

194. HYMENOPHYLLUM FLEXILE Makino. Plate 80.

Hymenophyllum flexile MAKINO, Bot. Mag. Tokyo 13 (1899) 45.

Rhizome wiry, wide-creeping laxly branched, darkish-brown, nearly naked, rooting. Stipes loosely placed on the rhizome, slenderly elongate, wiry, hard, naked but margined with narrowly crispate wings on both sides except the lower portion, shorter than the frond, 2–9 cm in length. Frond lanceolate, or broadly lanceolate, sometimes ovate-lanceolate, shortly subacuminate, 8–25 cm long, 3–5½ cm broad, tripinnatifid or subquadripinnatifid, thin, flexible, naked, but thinly and very minutely scaly on the rachis and nerves beneath, darkish ferruginous-brown when dry; pinnae usually erect-patent, 10–14 on each side, moderately closed, or laxly distant in the superior and inferior, narrowly triangular-rhomboidal, or sometimes rhomboidal-deltoid, often somewhat falcate, broadly cuneate at the base, very shortly petioled or nearly sessile, divided down nearly to the rachis into few or several pinnules on each side, lowest ones decreasing in size, largest ones about 5 cm long, nearly 2 cm broad; pinnules cuneate-ovate, deeply divided into few simple or bifurcate segments in the lower ones, but upper ones only bifurcate or simple; ultimate segments narrowly oblong, entire, obtuse or retuse at the apex, 1½–2 mm broad; main rachis slender, crispate-winged throughout, each lateral wing 1 to 1½ mm in width. Sori rather copious, laxly disposed except the apical and lower portions of frond, 1 to 15 to a pinna, terminating the inner lower segments of the pinnules, rounded or broadly rounded, rounded at the base, 1½–2½ mm each way; involucre divided down to very base, naked; valves orbicular, sometimes truncate in front, erose-dentate on

front margin; sporangia numerous, clustered in capitate manner on the top of a short receptacular columa, included, very shortly pedicellate, with incomplete ring.

Nom. Jap. *O-kokeshinobu.*

Hab. Prov. Kii; Mt. Nachiyama (*Z. Matsumura!* herb. Sc. Coll. Imp. Univ. Tokyo, July 25, 1883; *M. Miyoshi!* herb. l. c. Aug. 18, 1887); Prov. Tosa: Near Mt. Tobako-yama (*T. Makino!* Aug. 1886), Mt. Honokawa-yama (*T. Makino!* Aug. 10, 1887), Mt. Kurotaki-yama (*T. Makino!* Nov. 1892).—MAKINO, loc. cit.

Makino's description is good, although the axes are really not scaly, and the involucres are divided down to a very broad base; the valves are rounded or truncate, and vary from entire to rather deeply erose. The cell walls are thin and uniform. The head of the receptacle is much enlarged and moderately dilated, with the sporangia on long branches (sporangiophores, not stalks).

The species is closely related to *H. badium*, from which it is conveniently distinguished by the position of the sori, terminating many of the proximal segments of the medial part of the frond, but wanting near the apices of the frond and of the pinnæ.

Known only from Japan.

Represented in my herbarium by *Faurie 2912*, det. by Makino, *ipse* from Mount Kupisan, Kiushu; in the Phil. Nat. Herb. by *Tagawa 242*, topotypic, from Mount Nachi, Kii Province. Our illustrations are from the latter.

105. HYMENOPHYLLUM OPACUM Copeland sp. nov. Plate 81.

H. gregis II. badii lamina opaca et parietibus undulato-vittatis distinctum, rhizomate lignoso, 1.6 mm crasso, radices multas pilosas emittente, ipso glabro; stipite 5 ad 8 cm alto, 1 mm crasso, recto, fere ad basin alato; fronde ovata, ca. 15 cm alta, 8 ad 12 cm lata, subcoriacea, opaca, axibus conspicue alatis ala subundulata; pinnis erecto-patentibus, basi obliquis, sterilibus apice acutis, majoribus bipinnatifidis v. rarissime subtripinnatifidis, segmentis brevibus ca. 1.5 mm latis, plerisque emarginatis; soris in parte superiore frondis segmenta fere omnia terminantibus, involucro orbiculare, ad basin fisso valvis aut integris aut undulatis, receptaculi basi columnare sterile, capite valde et irregulariter dilatato, sporangiophoris conspicuis ubique obsito; parietibus inter cellulas laminae conspicue undulato-vittatis, marginalibus solummodo subundulatis.

NOVA GUINEA, Mount Nassau, altitude 1,500 m, *Docters v. Leeuwen 10946*, October, 1926; *Herb. Lugd.-Bat. 932.84-260*, sub *H. salakense* distrib.

The color, opacity, and shallowly dissected pinnules with contiguous segments, combine to produce an appearance suggestive of *Trichomanes obscurum*.

The pitting of the walls is not quite unique in this group, being like that of *Cuming 220*, which I discuss and illustrate under *H. badium*. Possibly that and the species here described are the same, but I cannot pass on this with the limited material. The Philippine specimen is lighter, narrower, and less divided; in a near relative of *H. badium* I do not regard the apparent difference in the receptacles as diagnostic.

164. HYMENOPHYLLUM WRIGHTII van den Bosch. Plate 82.

Hymenophyllum Wrightii VAN DEN BOSCH, Synopsis (1859) 61; NAKAI, Bot. Mag. Tokyo 40 (1926) 247.

Hymenophyllum oligosorum MAKINO, Bot. Mag. Tokyo 13 (1899) 44; NAKAI, Bot. Mag. Tokyo 40 (1926) 247.

Hymenophyllum coreanum NAKAI, Bot. Mag. Tokyo 40 (1926) 247.

Fronde late oblonga pinnatifida, lacinüs patulis contiguis 1–2 dichotomis dimidiatis (?), lacinulis latiusculis abbreviatis, cellulis opacis firmis rubro-fuscis magnis (imo maximis) elongato-hexaëdris acutangulis globulosis, globulis inaequalibus confertissimis diffusis, parietibus hyalinis tenuibus rectis, cellularum marginalium minute et obtuse crenulatis, soris in lacinüs axillaribus reflexis lacinula latioribus e basi conica immersa bilobis, lobis semicircularibus integris, receptaculo brevi. Rhizoma horizontale ramosum setaceum paleis piliformibus elongatis crispulis parce tomentosum; stipes mediotenus ala rhacheos descendente anguste marginatus vix ultra 7 millim. longus, frons 16 millim. longa, 10 millim. lata opaca firmiuscula rubro-fuscidula.

Hab. Japonia! (Hakodadi), *Wright*.—MAKINO.

I miss the type in Herb. Lugd.-Bat., but the type collection is in U. S. Nat. Herb. and Gray Herb. and is as described.

This is a dwarf form of *H. polyanthos*, from which it differs solely in size and in features necessarily correlated with loss of size—simplicity of frond. It varies like *H. polyanthos* in shape of involucre and immersion of the base. Like dwarfs in general, it is very inconstant in shape of frond. The structure is exactly that of *H. polyanthos;* ingrowths from the marginal wall are often present in the sinuses. I illustrate it by a frond from the type collection, and two fronds on the same rhizome of *Taquet 3635*. The latter are of the size most usual in collections bearing this name. I suspect that it will be possible to find in Japan every stage between these and those recognized as *H. polyanthos* (as *H. blumeanum* or *H. integrum* of Nakai).

Of *H. oligosorum* Nakai cites four collections, all from the one type locality. I have two, *Flora Japonica s. n.*, June, 1908,

and *Flora Japonica 3*, 1914, which, having no collector's name, may or may not be the same cited by Nakai; both are without fruit. *Faurie 4643* is also received with this name. In his key, page 243, Nakai distinguishes *H. oligosorum* with "Rachis late alata. Frons infra ciliata. Lobi frondis circ. 1 mm. lati obtusi," from *H. Wrightii* with "Rachis anguste alata. Frons infra glaberrima. Lobi frondis haud 1 mm lati retusi." I find hairs on young enough fronds of *H. Wrightii*, and none on old fronds of topotypic *H. oligosorum*. The other distinctions are relative, and I do not find them nearly great enough to sanction specific distinction.

The key distinction between *H. Wrightii* and *H. coreanum* is size, the latter being more minute; therewith it is less dissected. But the type collection of *H. Wrightii* would, by Nakai's criteria, better represent *H. coreanum*.

JAPAN, *Wright, Faurie 185, 186, 944, 2624, 4644, 5259, Rosenburg 14, Hayakawa 688, Sakurai 4, Ishida.* QUELPAERT, *Taquet 8635*. Specimens bearing this name by Ishiba are *Trichomanes parvulum*.

101. HYMENOPHYLLUM EXSERTUM Wallich. Plate 33.

Hymenophyllum exsertum WALLICH, Cat. No. 171; HOOKER, Sp. Fil. 1 (1844) 109, *pl. 38A*; BEDDOME, Ferns S. India, *pl. 9*, Ferns Brit. India & Malaya *pl. 16*; CHRISTENSEN, Cont. U. S. Nat. Herb. 26 (1931) 330, *pl. 24*.

Hymenophyllum Gardneri VAN DEN BUSCH, Synopsis (1859) 71.

Hymenophyllum Delavayi CHRIST, Bull. Soc. Bot. France 52, Mém. 1 (1905) 11, *teste* Christensen.

Hymenophyllum exsertum, Wall.; flexile pendent, fronds oblong elongate acuminate pinnated, pinnae rather distant lanceolate acuminate decurrent especially the upper ones pinnatifid but not deeply, segments short linear-oblong obtuse entire simple or bifid, involucres on the upper side of the pinnae solitary or 2–3 sessile or terminating short segments ovate 2-valved almost to the base compressed, the valves eroso-serrate or nearly entire, rachis stipes and costa more or less crinite with long scattered rufous hairs. (Tab. XXXVIII. A.)—*Wall. Cat. n. 171*. H. densum, *Wall. Cat. n. 170*.

Hab. Nepal, *Wallich*.—A well-marked species. The pinnae are decurrent, broad and not deeply pinnatifid.—HOOKER, loc. cit.

On the specimens in hand, ex Herb. Musei Brit., the Wallich names reverse those cited by Hooker, *170* being *H. exsertum* and *171 H. densum*, which agrees with Wallich's "published" List; *H. densum* was never properly published.

Very variable in size, the largest and finest specimens coming from the Khasia Hills, *Mann*, more than 10 cm long and up

to 4.5 cm wide, and symmetrical, bipinnatifid with forked segments; smaller fronds with pinnæ varying in length are commoner elsewhere, and dwarfs seem not to be rare. Rhizome and stipe filiform, deciduously hairy; rachis winged throughout, or marginate or terete at the base, everywhere hairy on the nether side, the hairs 0.5 mm long but fragile and eventually deciduous, smaller hairs extending along the axes to the costæ; pinnæ remote or imbricate, lanceolate or ovate, the main veins wavy so that the branches are divaricate, but the costæ of forked segments branching at an acute angle, pinnæ pinnatifid to a broad wing or undivided middle portion, segments often narrowed to the apex; cell walls thin, slightly wavy and eventually slightly, irregularly, thickened; sori acroscopic, axillary on short or obsolete segments, the base of the involucre immersed, the lips irregular or inciso-crenate, rarely subentire, receptacle slender, included.

Throughout INDIA, Himalayan region, *Wallich 170, 171, Hooker and Thompson, Duthie 3656, Clarke 36481, 48914, Mann, Levinge, Anderson 1421, Strachey and Winterbottom;* Peninsular India, *Griffith, Gamble 18302, Noyes, Sauliere.* CEYLON, *Thwaites 1890.* YUNNAN, *Rock 7216.* SIAM, *Rock 1757, 1517* (involucre very variable). *Eryl Smith 1403* from Hainan may be this species.

Specimens bearing this name from Sumatra and the Malay Peninsula, and most of those from Ceylon, are *H. edentulum* (*H. macroglossum*), with peculiarly thickened walls and different involucre, and more glabrescent.

108. HYMENOPHYLLUM FLEXUOSUM A. Cunn. Plate 54.

Hymenophyllum flexuosum A. CUNN., Hook. Comp. Bot. Mag. 2 (1836) 369; Sp. Fil. 1: 105; GIESENHAGEN, Flora (1890) *pl. 16, fig. 15.*

Hymenophyllum javanicum part., HOOKER and BAKER, Syn. Fil. 60, non Sprengel.

Hymenophyllum australe part., auct. mult., non Willd.

Fronde ovata subacuminata tripinnatifida glabra, laciniis linearibus retusis apice nunc emarginatis, marginibus integerrimis undulatis, involucris orbicularis compressis solitariis geminisve, ore bilabiato integro vel emarginato, rachi stipiteque superiore alatis, alis undulatis flexuosis.

New Zealand (Northern Island). In humid forests, on decayed timber, Wangaroa.—1834, *R. Cunningham.*

Obs. This species differs from the preceding [*H. tortuosum*], its close ally, in the mouth of the involucre being wide, the lips almost altogether entire; and in the segments of the frond having no denticulations on their waved margins, which are obvious in that species. It comes also near to *Trichomanes crispatum* (Hook. t. 70); but that species is readily

distinguishable by the alated segments of its frond, not being at all undulated, and by the involucre being uniformly solitary, and of a more oval form.—CUNNINGHAM, loc. cit.

Rhizome branching and intricate, short-hairy when young, presently scurfy, finally glabrescent, woody, 0.8 mm thick; stipes up to a decimeter long, winged except at the base, wing widest at the top, 4 mm overall, the margin overfull and crisped; frond ovate or deltoid, up to 18 cm long, most ample forms quadripinnatifid and then the lowest segments forked, rachises winged like the stipe, the wing narrowing from the base upward, segments variable, commonly 0.6 mm wide, 3 to 5 mm long, entire; sinuses rounded and usually overfull; cell walls all thin, the internal ones wavy next to the surface; sori on short, usually lateral, laciniæ, involucre orbicular or narrower or broader, cleft to the broad base, the lip usually entire; receptacle with a large almost sessile head, wide and variable in width, with short sporangiophores, sporangia small. As in *H. badium*, twin sori are frequent, and forking of the axis at or above the base of the sorus results (rarely) in twin receptacles, or (often) in much dilated receptacles.

This is the New Zealand representative of the group of *H. badium*, not at all that of *H. javanicum* with which it has been confused strangely. It is recognizable at sight by the wide wing of the upper part of the stipe, with crisped margin but flat along the axis.

Endemic in New Zealand, apparently common in both islands. The best collection is by *Setchell*, five sheets in Herb. Univ. Calif. Others seen are: *Cunningham, Herb. Lugd.-Bat. 908, 280–302*, probably the type collection, small and immature; *Hooker, Brackenridge, Kirk 355, 568, Ranfft, Thompson, Bell, Holloway*.

108a. HYMENOPHYLLUM POLYCHILUM Colenso.

Hymenophyllum polychilum COLENSO, Trans. New Zealand Inst. 24 (1891) 395.

Plant terrestrial; rhizome subterranean, shortly creeping, naked, its rootlets very hairy; hairs dark-red, patent, often terminating in a minute round glandular-like ball. Frond membranous, 8 in.–11 in. high (stipe included), 3½ in.–4 in. broad at base, deltoid-acuminate, 3-pinnatifid, leafy, dark-green, suberect, slightly decurved; stipe (4 in.–5 in.) terete, glabrous, shining, rigid, more or less flexuous, dark-brown. Rhachis and subbrachises winged throughout, pinnæ close overlapping, their tips often elongated, simple and forked at apices, the lower ones decurved; sometimes the second pair from base are the longest, the lowest pair opposite with their large basal segments meeting over rhachis, pre-

senting a semicrisp appearance; segments broad, laciniate; lobes narrow-linear, entire, obtuse. Involucres on all pinnae, but mostly very numerous on upper two-thirds of frond, marginal on all sides and tips of segments and lobes, very large, wider than lobe, oblate, hemispherical and oblong, 2–4-fid to base, open, spreading, sometimes 2–3 together; lips entire, truncate, broad, sometimes once notched; here and there two clusters of sori are together within one involucre. Sori prominent, much exposed; capsules large, striking, each with a bright-red shining elastic ring.

Hab. Dry shaded woods south of Dannevirke, County of Waipawa; 1890–91; W. *C.*—COLENSO, loc. cit.

Not seen; probably near *H. flexuosum*, although Colenso compares its rather with *H. demissum*, and Cheeseman has reduced it to the latter species.

109. HYMENOPHYLLUM PULCHERRIMUM Colenso.

Hymenophyllum pulcherrimum COLENSO, Tasm. Journ. Nat. Sci. 2 (1844) 185; HOOKER, Sp. Fil. 1 (1844) 103, *pl. 37A*. HOLLOWAY, Trans. N. Z. Inst. 54 (1923) *pl. 61*.

Plant, climbing, fronds numerous, sub-erect, spreading, pendulous, glabrous, very membranaceous, epiphytical. *Frond*, rhombic-lanceolate, lax, margined, tripinnate; grass-green. *Pinnules; primaries*, rhombic-ovate, sub-acute, petiolate, alternate, remote, unequal: *secondaries*, triangular- or trapezio-ovate, retuse, petiolate, alternate: *tertiaries*, trapeziform, cuneate, and pinnatifid: *segments*, entire, linear, bifid, emarginate and retuse. *Involucre*, small, globose, sub-pedicelled, solitary, sub-terminal in sinuses of tertiary pinnules and segments, numerous, scattered: *Valves*, large, and entire. *Rachis*, winged, 8–11 inches; margin entire. *Stipe*, semi-terete, flattish, somewhat fleshy, brittle, winged to caudex, glabrous, densely fimbriated at base; margin entire. *Caudex*, creeping.

Hab. On reclining and prostrate trees, humid woods, shores of Waikare Lake; December, 1841.

Obs. This fine and very beautiful species becomes circinnate as it gets old. In affinity it somewhat approaches *H. flexuosum*, *R. Cunn.*; from which, however, it may at first sight be discriminated, by its being tripinnate, and by its winged stipe and rachis being destitute of undulations, & c.—COLENSO, loc. cit.

Hooker's publication, with an inaccurate reference to Colenso's, was made in the same year.

Rhizome the stoutest in the genus, 1 to 2 mm thick, densely beset with acicular reddish-brown hairs suggesting those of typical Dennstaedtiid ferns, stipe also stout, 5 to 10 cm long, narrowly winged to the base, the wing plane; frond 20 cm long, or up to 45 cm, and then very lax, ovate or narrowly ovate, quadripinnatifid, the minor axes and segments straight or sinuous, segments 1 mm or more wide; cells large, walls eventually irregularly but not greatly thickened, marginal walls thin except in the sinuses, which are two cells thick and usually also over-

full, parenchyma two cells thick for a short distance in the axes of the veins; sori on short lateral (mostly basal) segments, slightly wider than the segments, involucre cleft to the base, in general orbicular, valves inflated, fragile, entire; receptacle with sterile base enlarged gradually to the round head with small sporangiophores, included, standing in the middle of the involucre.

NEW ZEALAND, *Kirk, Cheeseman, Brame, Rauft, Holloway, Petrie.*

116. HYMENOPHYLLUM VILLOSUM Colenso.

Hymenophyllum villosum COLENSO, Tasm. Journ. Nat. Sci. 2 (1844) 185, London Journ. of Bot. 3: 35; KIRK, Trans. New Zealand Inst. 10 (1877) 395; HOLLOWAY, Trans. N. Z. Inst. 54 (1923) pl. 5.

Plant, climbing, few fronded, reclinate and pendulous, glabrous, epiphytical. *Frond*, ovate, sub-acuminate, tripinnate, 3 inches long; colour, tawny green. *Pinnules; primaries*, somewhat trapezio-lanceolate, acuminate, obtuse, petiolate, alternate, unequal; midrib, sub-flexuose: *secondaries*, somewhat rhombic-ovate, obtuse, petiolate, alternate; *tertiaries*, sub-pinnatifid, cuneate petiolate, alternate; *segments*, deeply incised, 2–6 lobed: *lobes*, linear, entire, truncate or slighty emarginate. *Involucre*, ovate, sub-acute and obtuse, solitary, sometimes in pairs, axillary in axillae of tertiary pinnules or lobes, pedicelled. *Valves*, large, entire, and much open. *Rachis, Petioles*, and *Ribs*, villous underneath, and margined; margin, entire, and slightly ciliated; *Rachis*, flexuose. *Stipe*, two inches long, winged to base, brittle and villous. *Caudex*, creeping.

Hab. On reclining and prostrate trees, dense shaded forests near Runtahuna; January, 1842.

Obs. This fern has a peculiarly strong smell, especially when dry. It appeared to be a scarce species, a few plants only being detected, and those in one locality.—COLENSO, Tasm. Journ. Nat. Sci.

Kirk's description is more complete, includes quadripinnate fronds up to 5 inches long, and makes the involucre round. The stipe is marginate in the upper part, terete near the base. The hairs are mostly deciduous with age, which explains Hooker's view, Sp. Fil. 1: 107, that it is "a subvar. [of *H. polyanthos β sanguinolentum*] with stipes and rachis very slightly hairy." The lamina is everywhere one cell thick. The walls are in general thin and straight, but irregularly somewhat thickened, and the internal ones finely wavy next to the surface. The receptacle has a sterile base, and an equally long, slender fertile region with prominent sporangiophores, all included.

As to affinity, Kirk says: "The affinities of our plant are with *H. polyanthos*, Swartz, and *H. demissum*, Swartz; from the former it differs in possessing longer and narrower segments

and terminal orbicular sori; it may readily be distinguished from the latter by its small size and orbicular involucres, which have entire lips and are broader than the segments. In color, texture, and the presence of hairs, it approaches *H. scabrum*, A. Rich."

Endemic in New Zealand, and only in the higher regions (above *H. sanguinolentum*). *Kirk 562, Cheeseman, Sledge, Brame, Haddrel, Holloway.*

III. HYMENOPHYLLUM AUSTRALE Willdenow. Plate 55.

Hymenophyllum australe WILLDENOW, Sp. Pl. 5 (1810) 527; HOOKER, Sp. Fil. 1: 108; VAN DEN BOSCH, Synopsis 50 *part.; auct. plur. recent. parte minima.*

Hymenophyllum atrovirens COLENSO, Trans. Journ. Nat. Sci. 2 (1344) 186. (?)

Hymenophyllum tasmannicum VAN DEN BOSCH, Synopsis (1859) 59, *teste* VAN DEN BOSCH, Ned. Kruid. Arch. 5' (1863) 198.

H. frondibus bipinnatis, pinnulis linearibus obtusis, inferioribus bifidis, soris terminalibus, indusiis emarginato-bidentatis, rachi alata, stipite marginato. W.

Südlicher Hautfarrn. W.

Habitat in Novae Hollandiae capite Van Diemen. 2l. (v. s.) La Billardière.

Caudex repens capillaris laevis. Stipes sesqui- vel bipollicaris marginato-subanceps. Frons bipollicaris bipinnata rubicundo-fuscescens. Pinnae semipollicares inferiores et superiores minores. Pinnulae bilineares, inferiores bifidae, laciniis linearibus obtusis, superiores simplices lineares obtusae. Sori in apicibus pinnularum solitarii. Indusia ovata apice emarginata vel obtuse bidentata. Rachis alata. W.—WILLDENOW, loc. cit.

Two important additions must be made to Willdenow's description: The wing of the axis is plane. And, underlying the adjoining halves of the marginal and the submarginal rows of cells, there is another row, making the lamina two cells thick along this line—an anatomical peculiarity long familiar in the case of *H. demissum*. This thickening is not quite everywhere present on any specimen, but is very evident on van den Bosch's fragment, ex Herb. La Bill., *Herb. Lugd.-Bat. 910, 28–84*, and on various specimens labeled *H. atrovirens*. Between these I find no valid distinction. From *H. demissum* it is distinguished by smaller size, axis winged throughout, and toothed lips of involucre—which last is probably diagnostic. The rachis might well be winged on dwarfs but not on large fronds. Material in hand is not sufficient for appraisal of the odor of *H. australe*. The type fragment has thickenings on the inside of the marginal wall, which I have not detected on other specimens.

Hooker, Sp. Fil. 1: 108, wondered that a Tasmanian species so well marked should not have been collected; but had already identified it (*leg. Gunn*) as *H. atrovirens*.

Range: Tasmania, New Zealand, Victoria?

Specimens: *La Billardière*, already cited; *Archer; Gunn*.

I am not sure that I have seen any New Zealand specimen of *H. atrovirens*. Specimens of *H. australe* ex Herb. Hooker as *H. crispatum* β without indicated origin may be from Tasmania, but are more probably from New Zealand. I feel sure about *H. tasmanicum*, but not equally sure about *H. atrovirens* to which its author reduced it.

I can see no near affinity between *H. australe*, which seems to me to be a reduced relative of *H. demissum*, and either *H. crispatum* or *H. javanicum*.

There are specimens from Tasmania, *Kershner* and *Lucas*, and New South Wales, *Boorman*, altogether like the *Gunn* collections of *H. australe* in gross appearance, and so named, on which the supplementary marginal strand of cells can nowhere be detected. The *Boorman* specimens have also thick and pitted or toothed walls, and mostly acute involucre lips. They are far from typical *H. australe*, but I still let the name stand.

112. HYMENOPHYLLUM DEMISSUM (Forster) Swartz. Plate 86.

Hymenophyllum demissum (Forster) Swartz, Schrad. Journ. 1800² (1801) 100, Synopsis 147, 374; Schkuhr, Krypt. Gew. *pl. 135 c*. First figured by Hedwig (not seen).

Trichomanes demissum Forster, Prodromus (1786) 85.

Hymenophyllum crispatum β, *Tasmanicum* Hooker, Sp. Fil. 1: 105.

Hymenophyllum Aucklandicum van den Bosch, Ned. Kruid. Arch. 3 (1859) 53.

T. demissum, frondibus bipinnatis: foliolis alternis strictis pinnatis: pinnis pinnatifido-dichotomis, segmentis linearibus obtusis integris: fructificationibus globosis terminalibus. F.—Forster, loc. cit.

Rhizome wide-creeping, woody, brown, naked, 1 mm thick; stipe commonly 10 cm tall, terete, brown; frond 12 to 20 cm long, brownish green, odorous, ovate, quadripinnatifid, lowest pinnae not or moderately reduced, rachis winged upward, naked or marginate near base, wing raised but not crisped; pinnules often shallowly incised, leaving an intact base and middle area, segments about 0.7 mm wide, 2 to 4 mm long; margin two cells thick in the sinuses and often along the whole margin; sori commonly paired, not rarely fused, simple sori usually only as wide as the segments with narrowly to broadly ovate involucre,

cleft to the broadly cuneate or horizontal base, the lips entire or, less commonly, crenate, fused sori varying from orbicular with emarginate lips and forked receptacle, to much broader, with deeply cleft lips and two separate receptacles; receptacle broadly clavate, densely beset with prominent sporangiophores.

Very variable in dissection and in form of sori, but well characterized by the two-layer marginal strand, and by the odor, which is that of *H. sanguinolentum* but not so strong; in both respects utterly unlike the Malayan *H. productum* with which it has been confused. Most simply and commonly, this strand is formed by a single row of cells underlying the adjacent halves of the marginal and the submarginal rows of cells. For a discussion of the various modifications of this structure (some of which I have not verified), see Mettenius, Hymenophyllaceæ, pages 458, 459. The first observation of the variable sori is credited to Hedwig.

New Zealand, apparently common (there are twenty sheets in U. S. Nat. Herb.) and always correctly named. With the type material of *H. aucklandicum* in hand, I can distinguish it in no way from a small *H. demissum*; *H. sanguinolentum* is a local relative; *H. australe* is a related dwarf.

113. HYMENOPHYLLUM DILATATUM (Forster) Swartz. Plate 87.

Hymenophyllum dilatatum (Forster) SWARTZ, Schrad. Journ. 1800[2] (1801) 100; Synopsis 147, 373; SCHKUHR, Krypt. Gew. 131, *pl. 135*; HOOKER and GREVILLE, Ic. Fil. *pl. 60*.
Trichomanes dilatatum FORSTER, Prodromus (1786) 85.
Sphærocionium dilatatum PRESL, Hymen. 35.
Diplophyllum dilatatum VAN DEN BOSCH, Synopsis 77.
Leptocionium sororium PRESL, Epim. (1849) 21, *pl. 11*.

T. dilatatum, frondibus subbipinnatis; pinnis alternis dichotomis decurrentibus cuneiformibus incisis, fructificationibus binualuibus orbicularibus inflatis. F.—FORSTER, loc. cit.

A large fern, for the genus, with stipe commonly 10 cm long and frond up to 30 (or even 45) cm by 10 to 15 cm wide, rachis winged throughout or only marginate at the base; pinnæ ovate with broad oblique base, acute or acuminate, bi- or tripinnatifid, with short, oblong segments 2 mm wide, entire, the lamina 3 (or 4) cells thick; sori terminal on any except the terminal segments of the pinnæ, in the upper part of the frond, involucre with base immersed, as wide as the segments or slightly wider, deeply divided, with entire valves; receptacle with sterile base, thence gradually widened to the very large globose fertile por-

tion, or the sterile base rarely inflated, sporangia on very short and inconspicuous protuberances.

Common in New Zealand. As every New Zealand specimen I have seen is correctly named, it is unnecessary to cite collections. Swartz and Schkuhr cite "Ins. Maris Pacifi" as the source of Forster's collection. Hooker, Sp. Fil. 1: 104, cites New Zealand, and I feel sure that he is correct. I have seen no specimen from any other place, although specimens so named in error are countless.

The infallible distinctive character is the thickness of the frond. This was recognized by Müller, van den Bosch, Mettenius (p. 461), Prantl (p. 23), and Giesenhagen, Flora (1890) 457, but it has not restrained almost all more recent writers from using this name for ferns with the typical family structure.

Leptocionium sororium Presl is described as having a clavate receptacle, a half longer than the involucre. The receptacle very nearly always falls short of the top of the valves. It is not unusual for the sporanges to protrude. By examining many specimens I have found two instances in which the receptacle itself protrudes. One of these, *Cheeseman 905, U. S. Nat. Herb. 816091,* is a freak frond with most of the major axes conspicuously elongate; the elongate receptacle conforms to the elongate segments. It is not to be regarded as specifically distinct. *Hymenophyllum sororium* van den Bosch, Synopsis 55, is not this species except as to the name-bringing synonym.

114. HYMENOPHYLLUM SCABRUM A. Richard. Plate 83.

Hymenophyllum scabrum A. RICHARD, Fl. Nouv. Zél. (1832) 90, *pl. 14, fig. 1.*
Sphaerocionium scabrum PRESL, Hymen. (1843) 126.
Diplophyllum? scabrum VAN DEN BOSCH, Synopsis 77.
Sphaerocionium glanduliferum PRESL, Epim. (1849) 22, *pl. 12.*

H. stipite ramoso rachique piloso-scabris; frondibus elasticis, lanceolatis pinnatis acutis; pinnis subbipinnatifidis; laciniis linearibus obtusis glabris, saepius apice bifurcatis; indusiis terminalibus obtusis, denticulatis bivalvibus.

Crescit ni Nova-Zeelandia. (D'Urville. v. s. s.)

Descriptio.

Stipes teres, 5–6 uncialis, piloso-scaber; frons elastica oblongo-lanceolata, 8–9 uncias longa, acuta, pinnata; pinnis alternis lanceolatis profunde bipinnatifidis; laciniis linearibus obtusis, saepius apice bifurcatis, glabris, nervo medio ejusque ramificationibus piloso-scabris, pilis raris; rachi partiali alata.

Indusia terminalia sessilia orbiculari-compressa, bivalvia, valvis obtusis, usque ad basin liberis, margine irregulariter denticulatis. Columna centralis valvulis brevior, apice ramosa et capsulas annulatas pedicellatas gerens.

Observations.

Par son extrême élasticité et par sa forme générale, notre espèce se rapproche assez de l'*Hymenophyllum elasticum* de Willdenow, trouvé dans les îles de France et de Bourbon par M. Bory de Saint-Vincent. Mais elle en diffère par plusieurs caractères, et entre autres par son stipe couvert de poils très-raides, par ses pinnules beaucoup plus elongées, plus écartées, glabres et non velues et ciliées. Elle a aussi quelques rapports avec l'*Hymenophyllum nitidum* Rob. Brown, mais s'en distingue par sa taille beaucoup plus grande, par ses stipes scabres, par ses pinnules bipinnatifides, etc.—RICHARD, loc. cit.

A distinct species, well characterized by its author. The remarkably coarse, "articulate" hairs of rhizome and stipe distinguish it from all other species. These are more or less deciduous, their more persistent bases at the base of the stipe being responsible for the specific name. Much reduced, the hairs extend along all axes, even to the costæ of the segments, on the nether surface. Presl, describing his *S. glanduliferum*, says, "Species singularis ob paginas frondis diversas." As noted by both van den Bosch and Mettenius, the lamina is three cells thick, in the manner of *H. dilatatum*, with the cells of the middle layer larger than those of the surface. Giesenhagen, Hymen. 457, construes this as an organ for the storage of water. Herbarium specimens are strongly scented, like *H. sanguinolentum*.

The lips of the involucre, when young, probably always bear glandular teeth (cf. Presl, Epim., pl. 12); but these are deciduous, leaving the lip denticulate, as described by Richard, or "scarcely denticulate" (Hooker, Sp. Fil. 1:110). The large-capitate receptacle is included; but the lips do not nearly enclose the large mass of the mature sporangia.

New Zealand, all collectors. A specimen in the Gray Herb., *Prince*, is ascribed to Fiji, where it surely is not indigenous.

SPECIES NOT SEEN NOR PLACED

HYMENOPHYLLUM BALANSAE Fournier, Ann. Sci. Nat. V 18 (1873) 265.

Said to be near *H. Deplanchei*, and distinguished by having an entire margin; this would make it like *H. Baileyanum*. But it is also said to have an involucre cleft almost to the base, and an included receptacle. New Caledonia.

HYMENOPHYLLUM STREPTOPHYLLUM Fournier, Ann. Sci. Nat. V 18 (1872) 266.

Frond linear, 10 to 12 cm long, the distal pinnules bifid, involucre cleft to the base, valves oval-elongate, lips obscurely erose-denticulate. New Caledonia.

HYMENOPHYLLUM FUELLUM Cesati, Rend. Accad. Napoli 15 (1877) 23, 24.

"Sterile, certe juvenile. An generis?" New Guinea.

HYMENOPHYLLUM RINCENS Christ, Ann. Jard. Buit. II 4 (1901) 34.

Said to be in the group of *H. rarum*, and to differ from *H. praetervisum* in being entire. The impression I get from the description is that it belongs in the small group of *Meringium* species having entire margins.

1. Subgenus CRASPEDOPHYLLUM Presl

Hymenophyllum § *Craspedophyllum* PRESL, Hymen. 125.
Pachyloma VAN DEN BOSCH, Versl. Akad. Wet. Amsterdam 11 (1861) 318, non DE CANDOLLE (1828).

A monotypic "group," probably derived from *Mecodium*, characterized by a specialized marginal row of cells with black contents. A dwarf plant of New South Wales, reported also in Tasmania.

115. HYMENOPHYLLUM MARGINATUM Hooker and Greville. Plate 88.

Hymenophyllum marginatum HOOKER AND GREVILLE, Ic. Fil. 1 (1828) *pl. 34*.

Frondibus erectis di-trichotomis laciniis linearibus obtusissimis subundulatis marginatis integerrimis, involucris terminalibus solitariis rotundatis marginibus incrassatis integerrimis.

Hab. In Nova Hollandia, prope Port Jackson, inter Muscos. *Fraser.*

Caudex gracillimus, filiformis, pilosus repens.

Stipes duas tres lineas longus, erectus, filiformis, basi pilosus.

Frondes pollicares, sesquipollicares, di-trichotomae, membranaceae, pulcherrime reticulatae, areolis minutis rotundatis, costatae, basi attenuatae, laciniis linearibus, subundulatis marginatis, integerrimis, apice, *frondium sterilium*, obtusis, *fertilium* emarginatis.

Sori in sinu, ad apicem laciniarum, solitarii.

Involucrum rotundatum, bivalve, valvis subconvexis reticulatis integerrimis, marginibus incrassatis pulcherrime rubris.

Receptaculum filiforme, involucro brevius, apice, liberum.

Capsulae rotundatae, compressae, peltatae, annulatae, annulo integro.—HOOKER and GREVILLE, *loc. cit.*

This was remarkably well described, for its time.

In hand are a type fragment in Herb. Lugd.-Bat. and a collection by *Watts* in U. S. Nat. Herb. Simple fronds may bear sori; they are mostly about 2 cm long and 1.5 to 2 mm wide. The older internal walls are wavy-thickened.

The remarkable black border of an otherwise very distinct species led Presl, Hymen. 125, to establish for it a section, *Craspedophyllum*, with the remark that it would probably constitute a genus; for which van den Bosch proposed a new name, *Pachyloma*.

Reported in Tasmania, as well as in New South Wales.

Specimens: NEW SOUTH WALES: *Watts, Baüerlein.*

6. Subgenus SPHAEROCIONIUM (Presl)

Sphaerocionium PRESL, Hymen. (1843) 125, as genus.

Margin ciliate with stellate hairs—either stellate as several springing from one marginal cell, or with a stalk cell bearing branches at its apex; margin entire except as the hairs may arise from obscure projections—at any rate not serrate; cell walls usually thin, uniformly thickened if thickened at all, chloroplasts very small and numerous; sori immersed in the apices of otherwise unmodified segments, involucre with a broadly cuneate or rounded or truncate (or even cordate) base, cleft to where the sides of the base meet the sides of the segment, with short, broad, ciliate lips, receptacle included.

Tropics and South Temperate Zone of both hemispheres, most abundant in the American Tropics.

The type of the group, of Presl's genus, is *Hymenophyllum hirsutum* Swartz, described from Jamaica, wide-spread in tropical America, and accredited to Africa. I have seen no African specimen and mistrust its occurrence there. Presl's genus was characterized essentially by the receptacle. It comprised three sections—with margins with stellate hairs, with simple hairs, and hairless. I include in the group at least a part of the second section; but none of the third, which was an assemblage of very diverse elements.

The species treated here all have fronds pinnate in plan. As in many of the groups of this family, dwarfing occurs in this one; and, as in other groups, this dwarfing involves the loss of characteristics, in form, and eventually in structure. The dwarf derivatives of *Spaerocionium* are omitted here because they have been treated collectively in my Trichomanes, under the group "5. *Microtrichomanes*," pp. 153–163. Of the species there treated,

"*T.*" *Lyallii* is altogether a *Sphaerocionium*, and was properly first named *Hymenophyllum*. "*T.*" *palmatifidum* clearly belongs with it, and has once been named as a *Hymenophyllum*—*H. borneense* Hooker, Synopsis (1866) 62. "*T.*" *Ridleyi* is its near relative. "*T.*" *sibthorpioides* has this and several other specific names in *Hymenophyllum*. *Trichomanes digitatum*, *T. dichotomum*, and *T. taeniatum*, in spite of more *Trichomanes*-like involucres, probably go with the foregoing; any kind of ciliate margin is out of place in *Trichomanes*. *Trichomanes nididulum* and *T. Francii* are without marginal hairs, but their ancestors probably did have them. Thus the whole of the group, *Microtrichomanes*, as I used the term (not as Prantl used it), belongs rather in *Hymenophyllum*, as that term is used here.

Reduction has gone still farther in this group. "*T.*" *barklianum* and "*T.*" *liberiense* are derivatives of *Sphaerocionium*, reduced to simple fronds. Most Hymenophyllaceæ with simple fronds are trichomanoid, having some kind of false veins, which would be as foreign a feature in *Hymenophyllum* (or *Sphaerocionium*) as marginal hairs in *Trichomanes*.

Key to the species of the subgenus Sphaerocionium.

Hairs absent on laminar surface.
- Hairs mostly simple, though tufted.
  - Laminar cells small. (Mauritius and Bourbon.) 116. *H. hygrometricum.*
  - Laminar cells large. (Hawaii.) 117. *H. lanceolatum.*
- Hairs with a very short stalk-cell. (Madagascar.) 118. *H. Poolii.*
- Hairs with an elongate stalk-cell.
  - Rachis and stipe winged. (Madagascar et al.) 119. *H. ciliatum.*
  - Stipe terete.
    - Segments up to 1.5 mm wide.
      - Hair-branches few, ascending. (Hawaii.) 124. *H. obtusum.*
      - Hair-branches spreading, mostly 4 or more.
        - Involucre roundish.
          - Rachis mostly winged. (Malaya.) 122. *H. pilosissimum.*
          - Rachis mostly terete. (Madagascar et al.) 120. *H. capillare.*
        - Involucre very short. (South Africa.) 121. *H. Marlothii.*
    - Segments about 2 mm wide. (New Guinea.) 123. *H. subobtusum.*

Hairs present on laminar surface.
- Rachis broadly winged. (West Africa.) 125. *H. splendidum.*
- Rachis largely terete. (New Zealand.) 126. *H. ferrugineum.*

116. HYMENOPHYLLUM HYGROMETRICUM (Poiret) Desvaux.

Hymenophyllum hygrometricum (Poiret) Desvaux, Prod. (1827) 333.

Trichomanes hygrometricum Poiret in Lam. Enc. 8 (1808) 79.

Hymenophyllum elasticum Willd., Sp. Pl. 5 (1810) 520; Hooker and Greville, Ic. Fil. *pl. 135.*

Sphaerocionium elasticum Presl, Hymen. 126.

Hymenophyllum flavo-aureum Bory, in Bélanger, Voyage, Bot. 2 (1833) 84.

Trichomanes frondibus subbipinnatis, foliolis alternis, pinnatifidis; pinnulis incisis, obtusis; surculis reptantibus, tomentosis. (N.)

Cette espèce a été recueillie par M. de Petit-Thouars, a l'île de Madagascar. (V. f.)—Poiret, loc. cit.

Stipe 4 to 8 cm long, firm, terete, glabrescent; frond 8 to 15 cm long or longer, usually narrowly ovate, acuminate, tripinnatifid, rachis winged toward the apex only, clothed with deciduous, mostly tufted, rarely branched hairs; segments short (pinnules therefore with uncut middle area), 0.6 to 0.9 mm wide, ciliate, the hairs in clusters of 4 to 6 from a discolored but not salient marginal cell, simple, costæ similarly setose, more densely beneath, and with some branched hairs; cells small with very thin, even walls; sori terminal on any segments, involucre not wider than the segments, hardly 1 mm long including the hairs, cleft to the broadly cuneate or subtruncate base, lips short, broadly rounded, ciliate with simple or stellate hairs.

Hymenophyllum hygrometricum and *H. elasticum* were identical. *Hymenophyllum flavo-aureum* was supposed to be larger, peculiar in color, and less elastic; it does not seem to be even varietally distinguishable. *Hymenophyllum telfairianum* Wall., List No. 168; Hooker Sp. Fil. 1 (1844) 113, is listed as another synonym (Kuhn, Fil. Afric. 40), but should be regarded as a *nomen nudum* of unknown application.

Specimens: *Bory.* Mauritius, *Sieber, Sym. Fil. 78, Fl. Mixta 294, Commerson, Person, Beusher.* Bourbon, *Vieillard and Deplanche.*

116a. HYMENOPHYLLUM FULVUM van den Bosch.

H. fulvum van den Bosch, Ned. Kruid. Arch. 5' (1863) 196.

Sphaerocionium hirsutum Herb. Reg. Berol. (non Pr.). Fronde e basi latiore oblonga vel ovato-oblongo superne bipinnatifida, inferne pinnata, pilis fulvo-ferrugineis variis vestita; laciniis superioribus e basi cuneata oblongis erecto-patulis leviter contiguis pinnatifidis, inferioribus elongatis basi latioribus patulis remotis, rhachi inferne nudâ subpinnatis, cunctis per paria approximatis; secundariis superne simplicibus dichotomisve, inferioribus pinnatifidis, lacinulis simplicibus latis minute denticulatis, denticulis piliferis, pilis stipitatis radiatis furcatisve; rhachi universali et pinnarum partiali inferiorum a medio deorsum terete setaceo pilis elongatis laxe ob-

sesso, venis venulisque validiusculis nigrofuscis; cellulis opacis vel centro nebuloso-diaphanis mediocribus inaequalibus elongato-hexaëdris, parietibus opacis fuscis rectis, interarcis grumulosis e flavescente fuscis s. totam cellulam implentibus spissis, s. lumen oblongum diaphanum relinquentibus dilutioribus, marginalibus parvis semihexaëdris; soris in lacinulis laciniarum superiorum terminalibus parvis lacinulis angustioribus, indusio e basi plus minusve rotundata cupuliformi subbilobo, lobis parum productis rotundatis integris longe ciliato-pilosis; stipite tereti flexuoso fusco glabrescente 6 centim. longo. Rhizoma-, frons 1 decim. et ultra longa, supra casin 5, apicem versus 1½ centim. lata e fusciculo olivacea membranacea tenera diaphana hygroscopica, lacinularum latitudo = 1 millim.

H. lanceolatum consimile differt: fronde lanceolata universe minus divisa, lacinulis duplo angustioribus pilis simplicibus furcatisve succinctis, cellulis vix elongatis, parietibus diaphanis tenuissimis, interarcis rubrofuscis soris duplo majoribus, indusio e basi concava bilobo, lobis productis semi-circularibus parce ciliatis, etc.

Hab. Madagascar. (Herb. Berol. sine inventoris nomine).

—Van den Bosch, loc. cit.

The type is *Herb. Lugd.-Bat. 910.29–32*, a complete frond in full fruit, but too old and worn to afford sure judgment of its original pubescense. It differs from *H. capillare*, to which it has been reduced, in form, texture, structure, and pubescense, and is in all respects more like *H. hygrometricum*. When the sole datum regarding a specimen is its land of origin, there is a fair chance that even that is erroneous.

III. HYMENOPHYLLUM LANCEOLATUM Hooker and Arnott.

Hymenophyllum lanceolatum Hooker and Arnott, Bot. Voy. Beechey (1832) 103.

Fronde lanceolata (3-pollic, badia) pinnata, pinnis ovato-lanceolatis bipinnatifidis, laciniis linearibus obtusis erecto-patentibus marginibus pilosis, pilis erectis simplicibus solitariis vel subfasciculatis, stipite tereti hirsuto, rachi superne alata, indusiis subrotundis compressis longe ciliatis lacinias laterales terminantibus.

This is distinguished by its dark brown colour, the lanceolate circumscription of the frond, with erecto-patent divisions, fringed with upright hairs, and the ciliated nearly orbicular, indusia.

(Sandwich Islands)—Hooker and Arnott, loc. cit.

Fronds commonly 5 to 10 cm long (*Hitchcock 13988* contains one frond 18 cm long), ovate, sparingly tripinnatifid, rachis terete at the base, narrowly winged farther up, setose, the hairs sometimes once forked, segments up to 1 mm wide, ciliate with simple (very rarely forked) once-jointed setæ about 0.5 mm long, most commonly in tufts of 2, sometimes solitary or ternate, often strictly appressed to the margin, the costæ similarly setose but the setæ usually solitary; cells large, with exceedingly thin walls; sori on the ends of lateral pinnules of the upper pinnæ,

involucre somewhat broader than the segment, roundish, base rounded and short-winged, with a few setæ on the back, cleft to the wing, lips closely ciliate with solitary setæ, receptacle short, globose.

Endemic in Hawaii—many collections on Kauai, Oahu, and Hawaii.

118. HYMENOPHYLLUM POOLII Baker.

Hymenophyllum Poolii BAKER, Journ. Linn. Soc. Bot. 15 (1876) 413; CHRISTENSEN, Dansk Bot. Arkiv. 7 (1932) 11.

Rhizome thread-like, wide-creeping. Stipe 1½-3 in. long, filiform, thinly beset with fine spreading hairs. Frond lanceolate, 2–3 pinnatifid, 3–5 in. long, 2–3 in. broad. Pinnæ sessile, rhomboid, erecto-patent, ½ in. broad, cuneate-truncate on the lower side at the base, cut down to a distinct wing into close, ligulate, erecto-patent, one-nerved segments ¼–½ in. long, ½ line broad, only the lowest anterior ones in the most fully developed pinnæ forked. Texture very thin, delicate, and elastic. Hairs on the edge and ribs abundant, often conspicuously stellate. Main rachis filiform at the base, winged above the middle. Sori many to a pinna, terminal. Valves of the involucre hemispherical, densely ptilose.

Most like the slender varieties of *H. subtilissimum*, but the frond different in shape, and the secondary segments much longer and fewer.

(Madagascar.)—BAKER, loc. cit.

This is represented in U. S. Nat. Herb. by *Perrier 7514*, bearing Christensen's note "typical t. sp. orig. Kew." The rachis is terete above the lowest pinnæ, elsewhere winged. The hairs on margin and costa are branched at the top of a very short basal cell; they may be solitary but are more commonly binate; the branches are 2 to 5. A common but not constant arrangement is that from one marginal cell there spring two hairs; one closely appressed to the margin, with two branches; the other, reflexed over the lamina, or growing in any direction, with four—less commonly, five—branches. Cells large, with thin, straight walls. Sori as wide as the segments, the sides of the tube forming a right or obtuse angle at the base.

Endemic in Madagascar.

119. HYMENOPHYLLUM CILIATUM Swartz.

Hymenophyllum ciliatum SWARTZ, Schrad. Journ. 1800' (1801) 100 (not seen); Syn. Fil. (1806) 147; CHRISTENSEN, Dansk bot. Arkiv. 7 (1932) 12.

Sphaerocionium ciliatum PRESL, Hymen. 126.

Hymenophyllum boryanum WILLDENOW, Sp. Pl. 5 (1810) 518; HOOKER, Sp. Fil. 1 (1844) 89, *pl. 31, c.*

Sphaerocionium boryanum PRESL, Hymen. 126.

H. ciliatum, frond, bipinnatis deltoideis, pinnis decurrentibus, pinnulis lincaribus obtusis subbipartitis ciliatis; stipite marginato. Fl. Ind. occ. p. 1753. Hedw. fil. ic.

Jamaica.—SWARTZ, Synopsis 147.

This was described from Jamaica but is accredited to all tropical America, tropical and South Africa, the islands of the Indian Ocean, Sikkim, and New Zealand. From South Africa, Sikkim, and New Zealand I have seen no specimen. The plant of Madagascar, Mauritius and Bourbon is *H. boryanum*, which I find it impractical to distinguish from the typical plant of Jamaica. Hooker, loc. cit., noted their similarity but thought the shape of the involucre was distinctive. In *H. boryanum* this is usually round with a round base; but the base is sometimes truncate, rarely obliquely cordate. In typical *H. ciliatum*, the cordate form, whether equal-sided or oblique, is commoner, but round bases are not rare. Form of frond, pubescence, and texture are identical.

Stipe about 2 cm long, broadly winged in the upper part; frond about 5 cm long (sometimes much larger), ovate, varying to deltoid and lanceolate, bipinnatifid with the larger pinnules forked (large forms more divided), rachis broadly winged, segments 1 to 1.5 mm wide (1 mm in Jamaica) ciliate with branched hairs borne on basal projections of the margin which leave it denticulate after the hairs are lost, hairs with a basal cell more or less one-third the length of the hair and discolored red at the apex, whence spring most commonly three divaricate or horizontal branches, similar hairs on rachis and costæ; cells large, with thin walls; sori cleft to the base or nearly so, lip of the involucre densely ciliate with simple and branched hairs, receptacle clavate-cylindrical, hardly as long as the involucre, with prominent sporangiophores.

Specimens: MADAGASCAR, *Goudot*, fragment in Herb. Lugd.-Bat., *Hildebrandt 4182*, *Forsyth-Major 208*, *Humbert 6444* (Christensen says this is the commonest local species). MAURITIUS, *Ayres*, *Sieber Syn. Fil. 139*, *Fl. Mixta 293*, *Person*. BOURBON, *Commerson*. KAMERUN, *Zenker 3881*.

11a. HYMENOPHYLLUM BOUTONI Baker.

Hymenophyllum Boutoni BAKER, Fl. Mauritius and the Seychelles (1877) 462.

Stipe under an inch long, winged at the top. Frond lanceolate, bipinnatifid, 2–3 in. long, ½–¾ in. broad, thinly pilose, with the main rachis distinct-

ly winged throughout. Pinnae cuneate-deltoid, the lower consisting of 4–6 ascending entire segments, which are 2–3 in. long by ¼ in. broad. Sori many to a pinna, terminal on all the segments, and broader than they are. Involucre immersed at the base, densely matted with ferruginous hairs; valves semicircular.

Mauritius, *Bonton!* Endemic. Intermediate between *H. ciliatum* and *lineare*, with the narrow frond and cutting of the latter, and the winged main rachis and large involucre of the former.—BAKER, loc. cit.

I have seen no specimen of this, and for this reason hesitate to reduce it; but there is nothing in the description to distinguish it from a narrow form of *H. ciliatum*, well known in Mauritius.

120. HYMENOPHYLLUM CAPILLARE Desvaux.

Hyenophyllum capillare DESVAUX, Mém. Soc. Linn. Paris 6 (1827) 333; CHRISTENSEN, Dansk bot. Arkiv. 7 (1932) 12.

Hymenophyllum pendulum BORY, in Bélanger, Voyage, Bot. 2 (1833) 81, *pl. 8, fig. 2*.

Sphaerocionium pendulum PRESL, Hymen. 126.

Frondibus subtripinnatifidis; pinnis infimis remotis, rariis; pinnulis utrinque pilosis subpalmato-pinnatifidis; laciniis denticulatis obtusis subcontiguis; rachi sinuosa, nuda, capillari, hirsuta. Trich. hirsutum Du Pet.—Th., Flor. Trist. d'Acug., p. 34. Exsl. syn. L. Crescit in insula Tristan-d'Acugna. Proximum Trichom. tricophylli sed laciniis latioribus basi magis decurrentibus.—DESVAUX, loc. cit.

HYMÉNOPHYLLE PENDANT Hymenophyllum (pendulum). *Fronde linéari dependente, pinnato, pinnulis alternis hirsuto-sericeis, cuneato-subdeltoideis, profunde lacinïatis, laciniis obtusis extremitate fructiferis.*

Habitat. Les hautes forets de l'île de Mascareigne.—BORY, loc. cit.

I give Bory's diagnosis; being sure of his plant, but not of Desvaux's, retaining Desvaux's name in deference to usage. *Hymenophyllum fulvum* van den Bosch has been regarded as another synonym, incorrectly in my opinion. Presl's name must apply to Bory's plant, but Presl misplaced it, among species with simple, not stellate, hairs.

Stipes 3 to 6 cm long, terete, filiform, clothed with partly deciduous branched hairs, fronds up to 40 cm or more long, 3 cm wide, bipinnatifid with the larger pinnules once or twice forked, rachis terete almost to the apex, hairy, segments 2 to 3 mm long, about 0.8 mm wide, margins and costæ densely beset with branched hairs, with short or long stalk cells, 3 to 5 branches and a total length reaching 0.5 mm or more. Cells large, moderately elongate, with rather thin walls; sori on any segments of the upper part of the frond, as broad as the segment, a scant millimeter long, involucre cleft to the broadly cuneate or truncate base, immersed in hairs, the lips rounded, closely dentate with teeth bearing long, branched hairs.

Specimens: MADAGASCAR, *Bory* (fragment in Herb. Lugd.-Bat. ex Mus. Paris), *Hildebrandt 1848.* EAST TROPICAL AFRICA, *Stolz 873, Daubenberger-Rosenst. Fil. Afr. or. germ. n. 2.*

Christensen reports a Madagascar form, *Perrier*, with fronds 10 cm long, 1 to 1.5 cm wide, with remote pinnae "deeply cleft into 2–3 spreading lobes." Still less-developed plants, *Pollen and van Dam*, called var. *minor* by Rosenstock, are probably young sporelings. In normal fronds, the lowest pinnae are remote, but all others are close or imbricate.

131. HYMENOPHYLLUM MARLOTHII Brause.

Hymenophyllum Marlothii BRAUSE, in Fedde's Repert. 11 (1912) 112.

Rhizoma longe repens, filiforme, juventute pilis fulvis stellatis instructum denique glabrescens, interstitiis 0,5–3 cm longis folia petiolata emittens. Petioli filiformes usque ad 5 cm longi pilis iis rhizomatis aequalibus muniti. Laminae ambitu lanceolatae vel subdeltoideae usque ad 12 cm longae 3 cm latae, utrinque pilis stellatis vestitae, subtripinnatifidae, pellucidae, membranaceae; pinnis 4–12-jugis, usque ad rachim fere pinnatipartitis, patentibus, ambitu rhombeis, subcontiguis, alternis, medianis maximis 2 cm longis, cr. 0,6 cm latis, inferioribus paulum decrescentibus remotisque, superioribus in apicem obtusiusculum succedaneo-desinentibus, usque ad costam 0,9 mm alatam pinnatifidis vel bipinnatifidis; segmentis usque ad 3-jugis, linearibus vel pinnatifidis, alternis, margine integro vel levissime undulato pilis stellatis densis instructis; laciniis linearibus usque ad 1 cm longis, plus minusve 1,3 mm latis, obtusiusculis; rachibus costisque validis cr. 0,9 mm alatis utrinque pilis stellatis densis praeditis; nervis validis simplicibus vel furcatis prominentibus. Sori superiorem laminae partem occupantes exigui, laciniarum apicibus impositi. Indusium minimum, cupuliforme, 0,8 mm latum, 0,4 mm longum, pilis dense obtectum.

Peninsula Montis Tabularis, in saxosis umbrosis humidis silvarum. Skeleton ravine, 500 m. ü. d. M. (R. Marloth no. 6169.—Juni 1912.)

—BRAUSE, loc. cit.

The Herbarium Lugduno-Batavum has *Marloth 1751*, antedating the type collection by nearly 25 years, and *Wilms 1926;* the former fruiting freely. These specimens fall far short of the size given by Brause, the largest frond being 5 cm long, and correspondingly less divided. The hairs are like those of *H. pilosissimum*, long, and with a long basal cell. Thus their stellate distal parts are scattered over the (mostly nether surface of the) lamina, but none originate there; they are mostly binate along the margin, solitary along the veins, and have commonly 4 or 5 branches. The laminar cells are large, with thin walls, and a thin layer of dense material closely appressed to them, leaving most of the area perfectly transparent. The sori are variable, sometimes as small as described by Brause, some-

times as wide as the segments, always relatively short, setose, and the lips ciliate with mostly forked hairs.

The short involucres provide the only convenient distinction from *H. pilosissimum*.

Endemic in South Africa.

122. HYMENOPHYLLUM PILOSISSIMUM Christensen.

Hymenophyllum pilosissimum CHRISTENSEN, Gardens' Bull. 7 (1934) 213.

H. obtusum Bak. 1879: 38, Copel., Keys 307.—*H. obtuso* Hook. et Arn. Hawaiiensi species proxima et cum ea ab auctoribus false conjuncta, differt: majori; stipite exalato ad 3–4 cm. longo; lamina elongato-lanceolata, ad 10 cm. longa, 2 cm. lata, bipinnata-tripinnatifida, supra sparse subtus densissime pilis stellatis mulliter lanosa, rachi costique late alatis, segmentis 1 mm. latis.

Kinabalu, s. l. (Burbidge, type, Kew), Lumu Lumu to Kamborangah, on under sides of sloping tree trunks in mossy forest (H. 25460), Kamborangah (Cl. 28983).—Dutch Borneo: Kemul (Endert 4232, p. p.).—Papua: Hunsteinspitze (Ledermann 8460).

Among the species of the group of *H. ciliatum*, this is perhaps the most densely hairy. The undersurface is throughout covered with stellate hairs which bear, on the tip of a central stalk, 4–6 simple horizontal or suberect branches. In *H. obtusum* the midrib and margins only bear the stellate hairs; our species is more narrowly lanceolate in outline, somewhat narrowed toward the base and the apex, though the apex may be sometimes rounded-obtuse. The sori are placed on the tips of the upper segments, the indusia almost as wide as the segments, divided nearly to the base, the valves rounded, densely hairy, sporangia very large.

To this species belong, I think, all other Malayan and Melanesian specimens called by other authors *H. obtusum* and *H. subtilissimum*.

—CHRISTENSEN, loc. cit.

The stated distinctions from *H. obtusum* are not very satisfactory. Thus: *H. pilosissimum* is usually larger, and almost always more slender; but there are Hawaiian collections which match *H. pilosissimum* in these respects, and Philippine collections which match *H. obtusum*. The stipe of adult *H. obtusum* is likewise wingless, and the rachis of *H. pilosissimum* is often terete near the base. The nether surface of *H. pilosissimum* is indeed covered by stellate hairs, but Hooker's eye was truer when he wrote of *H. obtusum* (Sp. Fil. 1: 93): "Hairs copious, confined to the costa and margin, many lying flat over the surface of the frond." The hairs which cover the nether surface of both species spring mostly from the margin, partly from the costa, none from the laminar surface. The best distinction is provided by the stellate hairs. The central stalk is commonly twice as long in *H. pilosissimum*, and the branches are much more numerous—rarely less than 4, rarely 7 or 8—and spreading in

all directions, instead of practically all ascending. It is the size of the hairs and the number of branches that make this much the more woolly species. The cell structure is identical, and so are the sori, except that here again *H. pilosissimum* is much more woolly.

Specimens: BORNEO, *Holttum, 25460, Clemens 28983* (both cited by Christensen). PHILIPPINES, *Elmer 6021, 9023, 9987, 10062, 13796, Merrill 6087, Bur. Sci. 9788, 15344, 23641, 28399, 30408, 37031, 40627, 41906.*

123. HYMENOPHYLLUM SUBOBTUSUM Rosenstock.

Hymenophyllum subobtusum ROSENSTOCK, in Fedde's Repert. 9 (1910) 71.

Hymenophyllum; rhizomate filiformi, repente, ramoso, caespitoso, pilis longis, rufo-fuscis, pedicellato-stellatis hirsuto, folia subapproximata gerente; stipitibus 1–2 cm longis, teretibus, exalatis, stellato-pilosis; laminis ad 2–5 cm longis, 2 cm latis, e basi late cuneata linearibus vel oblongis, obtusis, nervis margineque exceptis glabris, subpinnatifidis; pinnis alternis, suberectis, medialibus maximis c. 12 mm longis, 4 mm latis, pianulis 1–2 utrinque instructis, ceteris brevioribus, furcatis simplicibusve; pinnulis et laciniis c. 6 mm longis, 2 mm latis, linearibus, apicem versus paullo angustatis, obtusis, plerisque emarginatis, margine pilis rufo-fuscis, fasciatis, elongatis, apice furcatis vel stellatim radiatis dense vestitis; rhachibus subflexuosis, elastice curvatis, totis alatis, cum venis venulisque fusco-atris, uti margines frondis pilosis; soris apices laciniarum frondis superiores ac mediae terminantibus, e basi latissime cuneata subrotundis, latioribus quam longis; indusio mediotenus bivalvi, integerrimo, apice densissime hirsuto.

Nova Caledonia: In monte Tao, 800 m alt.; I. 1910, L. *Franc. no 1421.*

Von dem ihr zunächststehenden *H. obtusum* Hk. et Arn. unterscheidet sich diese Art durch elastische Krümmung des Blattes, etwa doppelt so breite letzte Abschnitte, längere Stiele der Sternhaare und durch sternhaarige Bekleidung des Rhizoms.

So far as the limited material in the type collection shows, this is like *H. pilosissimum* in form of frond; more like *H. obtusum* in ascending branches of the hairs; different from both in having wider segments and longer hairs. The stalk cell of the marginal hair is about 0.5 mm long; the entire hair, more than 1 mm. The cellular structure is identical. Branched hairs on the lips of the involucre are commoner in this species.

Endemic in New Caledonia, and known by the type collection only.

124. HYMENOPHYLLUM OBTUSUM Hooker and Arnott.

Hymenophyllum obtusum HOOKER and ARNOTT, Bot. Voy. Beechey (1832) 109; HOOKER, Sp. Fil. 1: 93, *pl. 33, D.*

Frondibus caespitosis oblongis obtusissimis tripinnatifidis, laciniis (approximatis) linearibus erecto-patentibus, costa marginibusque pilis longis

stellatis obsitis, stipite gracillimo hirto, indusiis (in laciniis supremis) terminalibus orbicularibus pilis ramosis dense ciliatis.

This may be known from *H. hirsutum* by the longer branched or stellated hairs, which are confined wholly to the midrib and margin. The ultimate laciniae are somewhat corymbose, generally reaching to the same height, so as to give almost a truncated appearance to the outline of the frond.

(Sandwich Islands.)—HOOKER and ARNOTT, loc. cit.

Rhizome and stipe filiform, hairy with mostly simple but occasionally branched or stellate hairs; fronds up to 8 cm, but more commonly 3 to 4 cm long, the usual form, although the basic division is pinnate, being flabellate in appearance so that the fronds may be as broad as long, with a broad, rounded or truncate apex, the less common long forms (*Hildebrand*, collected in 1870, in Herb. Copeland, but not in U. S. Nat. Herb.; *Emma B. Freeman* in U. S. Nat. Herb.) lanceolate or oblanceolate, and pinnate in appearance as well as in fact; segments 5 to 8 mm long (less in small forms), about 1 mm wide, the margin and costa densely setose, the marginal hairs usually tufted, branched at the base only, or more generally consisting of a comparatively stout cell about ½ mm long bearing two or three more slender suberect branches; cells large with very thin walls; sori terminal on the segments and mostly in the margin or broad apex of the frond as a whole, involucre about as wide as the segments, cleft to a very wide-angled base, setose on the lower part of the back, the lips densely ciliate with mostly solitary and simple hairs, receptacle short, globose.

Endemic in Hawaii, so far as my specimens show, and very commonly collected there. Distinguished from its local relative, *H. lanceolatum*, by denser pubescence with more spreading and branched hairs; usually, also, by the form of the frond.

115. HYMENOPHYLLUM SPLENDIDUM van den Bosch.

Hymenophyllum splendidum VAN DEN BOSCH, Ned. Kruid. Arch. 5' (1863) 192.

Hymenophyllum Plumieri KUHN, Fil. Afric. (1868) 41. *vix* HOOKER and GREVILLE.

Fronde lanceolata vel lineari-lanceolata elongata bipinnatifida, laciniis primariis patulis vel erecto-patulis remotis (imo distantibus) rhomboideo-oblongis, secundariis erectis (apice saepe recurvis) contiguis 1–2 furcatis vel simplicibus, lacinulis late linearibus modice elongatis planis, apice rotundato integro, margine minute denticulato, pilis stipitatis simplicibus furcatisve rigidis flavescenti-diaphanis, rhachi flexuosa debili setacea, pariter ac venae, angulo patente, venulaeque angulo acuto exeuntes, nigrescente dense hirsuta, cellulis diaphanis teneris mediocribus inaequalibus hexagonis valde elongatis, parietibus hyalinis tenuibus minutissime denticulatis, interaneis amorphis parietalibus difutiusculis flavescenti-fuscis,

medium oblongum hyalinum relinquentibus, marginalibus parvis angustis elongatis semihexaëdries, soris in laciniis terminalibus immersis mediocribus, indusio basi late rotundato-conico, mediotenus biloho, lobis semi-circularibus denticulatis ciliatis, receptaculo filiformi incluso, stipite apice alato setaceo flexuoso debili rufofusco hirsuto. Rhizoma repens ramosum setaceum pilosum, frons usque 4½ decim. longa, 5 centim. lata debilis (pendula) membranacea diaphana olivaceo-fusca.

Hab. Africa occidentalis (Ins. Fernando Po), MANN (H. HOOK.).

—VAN DEN BOSCH, loc. cit.

The Herbarium Lugduno-Batavum contains, besides the "authentic Specimen" of van den Bosch, which as usual is a fragment, a full sheet received later from Kew. The rachis is broadly winged; segments 1.3–2 mm wide, denticulate with minute, hair-bearing projections, and bearing similar hairs sparsely scattered over the laminar surface, the hairs minute, mostly once forked (with only two branches); sori narrower than the segments, about 1.5 mm long, with broadly cuneate to truncate, immersed base, and rounded lips, denticulate with projections bearing minute forked or simple hairs.

I have seen this from Fernando Po only; it is credited with a range on the African continent.

It seems to me very distinct from *H. ciliatum*, to which it has been reduced. In the presence of hairs on the laminar surface, it resembles rather the American (Jamaican) *H. hirsutum* (L.) Sw.

174. HYMENOPHYLLUM FERRUGINEUM Colla.

Hymenophyllum ferrugineum COLLA, Mém. Sci. Torino 39 (1836) 30.

Hymenophyllum subtilissimum KUNZE, Anal. Pteric. (1837) 49.

Hymenophyllum Franklinia COLENSO, Tasm. Journ. 1 (1841) 278.

Hymenophyllum franklinianum COLENSO, Tasm. Journ. 2 (1844) 183.

Hymenophyllum acruginosum β HOOKER, Sp. Fil. 1 (1844) 94 (and teste Syn. Fil. 64, pl. 34, A), *non* Carmichael.

"H. undique ferrugineo-pilosum, stipite rachideque teretibus, fronde pinnata, pinnis alternis ovatis pinnatisectis, segmentis 2–3-fidis simplicibusque, laciniis linearibus obtusis, soris terminalibus globosis." NOB. (Ad rupes et arborum radices in sylvis umbrosis montium editorum ins. *Juan-Fernandez* Berter.).—COLLA, loc. cit.

The plant of Juan Fernandez is unknown to me, and its name for the New Zealand plant is accepted on faith.

Rhizome and stipe filiform, stipe 2 to 6 cm long, terete, dark, shining, naked in age except at the top; frond 10 to 18 cm long, lanceolate, tripinnatifid, rachis terete in the lower part, winged above, everywhere densely beset with solitary or clustered stel-

late hairs, segments 2 to 3 mm long, 0.6 to 1 mm wide, ciliate with clustered stellate hairs with four to six branches from stouter stalk-cells, the laminar surface also bearing some similar but solitary hairs; cells mostly isodiametric, small, walls thin and undifferentiated; sori as wide as the segments, and, except for the hairs, shorter than wide, involucre cleft to the immersed broadly cuneate or rounded base, lips long-ciliate with branched and stellate hairs, receptacle included, columnar.

Specimen: NEW ZEALAND, *Kirk 261, 803, Ranft, Cunningham, Petrie, Bell, Smith.* STRAITS OF MAGELLAN, *Safford 368*, bears no hairs on the lamina.

9. Subgenus APTEROPTERIS nomen novum

Lamina vera omnino carente, filamentis brevibus cellularum axibus frondis ubique excurrentibus pilis stellatis dense obtectis substituta, segmentis frondis deinde crasse filiformibus haud applanatis.

A single species, related to *Sphaerocionium* as shown by the stellate pubescence, endemic in New Zealand.

127. HYMENOPHYLLUM MALINGII (Hooker) Mettenius.

Hymenophyllum Malingii (Hooker) METTENIUS, Hymen. (1864) 423, *pl. 1, fig. 32 (non rite)*; GIESENHAGEN, Flora (1890) 445, *pl. 4, fig. 25.*

Trichomanes Malingii HOOKER, Garden Ferns (1862) *pl. 64.*

Caudex long, slender, filiform; stipites scattered on the caudex rarely more than an inch long, slender; fronds two to four inches long, oblong-lanceolate, tri-quadripinnate, or rather perhaps pinnatifid, destitute of any wing or foliaceous portion, consisting of rachis alone; the ultimate branches are often forked, and in the fertile fronds almost all the branches are soriferous at the apex, and the whole frond is clothed with a dense stellated pubescence of a ferruginous colour on one side and a pale grey on the other; involucres terminal, subhemispherical, of a thick and firm texture, obscurely two-lipped, and with the lips lobed; column scarcely exerted, thick, fleshy, fusiform.

Hab. *Mr. Maling*, it appears, is the fortunate discoverer of this remarkable hymenophyllaceous Fern on the ranges of Golden Bar, Middle Island, New Zealand, and *Mr. Brunner*, Surveyor General, Middle Island, on the "mountain-range between Blind Bay and Massacre Bay" (possibly the same locality).—HOOKER, loc. cit.

Mettenius, loc. cit., says *"H. Malingii* . . . bietet das einzige Beispiel unter den Hymenophyllaceen und Farnen überhaupt, wo alle und jede Spur einer blattartigen Ausbildung fehlt." Giesenhagen recognized the presence of parenchyma cells, each growing out into a "papilla." It is the multitude of these papillæ, standing closely side by side, and completely sheathing

the axes, which takes the place, physiologically, of the lamina; the layer of papillæ is protected in turn by interwoven horizontal branches of the stellate hairs, the stalk cells of which run out between the papillæ from the sclerenchyma sheaths of the bundles; sori on the apices of any or all segments, slightly wider than the segments but very small, about 1 mm long, the apex with two very short, broad lips, the entire involucre immersed in the stellate pubescence borne on every part of it; receptacle cylindric, usually a little longer than the involucre.

Specimens: NEW ZEALAND, *Kirk, Cheeseman, Sledge 120, Brame, Thomson, Ranft-Rosenstock, Fil. Novae Zeal. n. 9, Petrie.* TASMANIA, *Rodney.*

Without evident near relatives.

SPECIES ERRATIM SUB HYMENOPHYLLO DESCRIPTAE

HYMENOPHYLLUM?

Hymenophyllum Foxworthyi COPELAND, Philip. Journ. Sci. § C 12 (1917) 45 = *Trichomanes pallidum* Bl. broadly construed; more exactly *Crepidoneuron Braunii* van den Bosch.

Hymenophyllum Rolandi Principis ROSENSTOCK, Fedde's Repert. 9 (1910) 72.

This plant, "Hymenophyllum (ex opinione)" of Rosenstock, and easily recognized as "einen isolierten Typ," cannot, in my opinion, whatever its fructification, be included in the genus. It does appear to belong in the family. As between the two old genera, I would rather guess it to be *Trichomanes*, but regard it rather as a distinct genus—if it belongs in the family at all.

It was collected sterile on Mount Tao, altitude 700 m, by *Frane* in 1910, and is otherwise unknown. No specimen is in the Bonati Herbarium, but the Univ. Calif. Herb. contains an excellent specimen, sterile of course, from Rosenstock, ex Herb. Bonaparte.

ILLUSTRATIONS

[Drawings of Meringium are mostly by E. Barbe; of Mecodium by L. Aschmann. Photographs by the Bureau of Science.]

PLATE 1

Hymenophyllum ricciaefolium Bory. *Herb. Lugd.-Bat. 908, 232–729*, from Bourbon; *1*, frond, × 0.5; *2*, cells, × 380; *3*, sorus, × 30.

PLATE 2

Hymenophyllum pollenianum Rosenstock. Type, in Herb. Lugd.-Bat.; *1*, frond, × 1.5; *2*, cells, × 380; *3*, sorus, × 30; *4*, receptacle, × 30.

PLATE 3

Hymenophyllum macroglossum van den Bosch. Cotype, in Gray Herb.; *1*, frond, × 1.5; *2*, cells, × 380; *3*, sorus, × 30; *4*, receptacle, × 30.

PLATE 4

Hymenophyllum penangianum Matthew and Christ. Illustrated by the type of *H. semifissum*, in Phil. Nat. Herb.; *1*, frond, × 2.5; *2*, cells, × 380; *3*, sorus, × 30.

PLATE 5

Hymenophyllum prehydernicum Cesati. Figs. 1 to 3, *Clemens 22270*, in Phil. Nat. Herb.; *1*, frond, × 1; *2*, dorsal surface of pinnæ, × 1.3; *3*, sorus, × 20; *4*, *Clemens 22173*, cells, × 250; *5*, cells of type (Beccari), × 250; figs. 6 to 8, type of *H. Clemensiae*; *6*, frond, × 1.6; *7*, sorus, × 20; *8*, receptacle (broken), × 20; *9*, type of *H. halconense*, cells, × 250.

PLATE 6

Hymenophyllum pulchrum Copeland sp. nov. Type, in Phil. Nat. Herb.; *1*, frond, × 0.5; *2*, cells, × 380; *3*, sorus, × 30.

PLATE 7

Hymenophyllum edentulum Christensen. *1*, Type fragment in Herb. Lugd.-Bat., cells, × 380; figs. 2 to 3, *Bur. Sci. 78750* in Herb. Copeland; *2*, frond, × 1.5; *3*, sorus, × 15.

PLATE 8

Hymenophyllum Meyenianum Copeland. *1*, Frond, cotype of *H. serrulatum* in Phil. Nat. Herb. × 0.3; *2*, cotype of same in Gray Herb., cells, × 250; figs. 3 to 6, cells, × 250; *3*, *Bur. Sci. 23701*, from Rizal; *4*, *Weber 1448*, from Davao; *5*, *Elmer 9910*, from Negros; *6*, *Bur. Sci. 33505*, from Ilocos Norte; figs. 7 and 8, sori, × 10; *7*, cotype in Phil. Nat. Herb.; *8*, *Yates s. n.*, from Mount Banahao.

PLATE 9

Hymenophyllum vittatum Copeland sp. nov. Type, *1*, frond, × 1; *2*, cells, × 380; *3*, sorus, × 15.

Hymenophyllum Ramosii Copeland sp. nov. Type, *4*, frond, × 1; *5*, cells, × 380; *6*, sorus, × 15.

PLATE 10

Hymenophyllum bicolanum Copeland sp. nov. Type in Phil. Nat. Herb. *1*, frond, × 2; *2*, cells, × 380; *3*, sorus, × 30.

PLATE 11

Hymenophyllum campanulatum Christ. Cotype in Phil. Nat. Herb.; *1*, frond, × 2; *2*, cells, × 380; *3*, sorus, × 30.

PLATE 12

Hymenophyllum boutcense Copeland sp. nov. Type; *1*, frond, × 1; *2*, cells, × 380; *3*, sorus, × 15; *4*, three sori on one plant, × 6.

PLATE 13

Hymenophyllum Merrillii Christ. Cotype in Phil. Nat. Herb.; *1*, frond, × 1.5; *2*, cells, × 380; *3* and *4*, sori, × 30.

PLATE 14

Hymenophyllum holochilum (van den Bosch) Christensen. *1*, Type in Herb. Lugd.-Bat., cells, × 250; *2*, *Dakh van den Brink 5878* in Herb. Univ. Calif., frond, × 1; *3*, sorus of same, × 20; *4*, sorus of type, × 20.

PLATE 15

Hymenophyllum denticulatum Swartz. Figs. 1 to 5, *Mousset*, in Phil. Nat. Herb.; *1*, frond, × 1; *2*, detail of margin, × 52; *3*, cells, × 350; *4*, sorus, × 10; *5*, sporangium, × 52; *6*, *Bur. Sci. 17524*, tip of frond, × 3; *7* and *8*, *Palmer and Bryant 577*, in Herb. Univ. Calif., sorus, ventral and dorsal faces, × 10.

PLATE 16

Hymenophyllum Haseï Copeland. Cotype in Herb. Copeland; *1*, frond, × 1.5; *2*, cells, × 380; *3* and *4*, sorus, both sides, × 30; *5*, sporangium, × 78.

PLATE 17

Hymenophyllum oranthoides (van den Bosch) Rosenstock. Sumatra specimen in Herb. Lugd.-Bat.; *1*, frond, × 1; *2*, cells, × 380; *3*, sorus, × 15; *4*, receptacle, × 30.

PLATE 18

Hymenophyllum blandum Raciborski. Figs. 1 to 3, *Elmer 11690*, in Phil. Nat. Herb.; *1*, frond, × 2.5; *2*, cells, × 380; *3*, sorus, × 30; *4*, sorus of cotype, × 30.

PLATE 19

Hymenophyllum johorense Holttum. Type, in Herb. Singap.; *1*, frond, × 3.3; *2*, cells, × 250; *3*, hair, × 250; *4*, sorus, × 20; *5*, sporangium, × 52.

PLATE 20

Hymenophyllum reductum Copeland sp. nov. Type; *1*, frond, × 3; *2*, cells, × 380; *3*, marginal hair, × 78; *4*, sorus, × 15.

PLATE 21

Hymenophyllum Rosenstockii Brause. Cotype, ex Mus. Bot. Berol.; *1*, frond, × 2; *2*, cells, × 380.

Hymenophyllum herterianum Brause. Type fragment, ex Mus. Bot. Berol.: *3*, cells, × 380.

PLATE 22

Hymenophyllum ovatum Copeland. Type, in Herb. Copeland; *1*, frond, × 2; *2*, cells, × 380; *3*, sorus, × 30; *4*, sporangium, × 78.

PLATE 23

Hymenophyllum Forsteri Rosenstock. Cotype, in Herb. Univ. Calif.; *1*, frond, × 1; *2*, cells, × 380; *3*, marginal tooth, × 78; *4*, sorus, × 15; *5*, receptacle, × 15.

PLATE 24

Hymenophyllum viride Rosenstock. Type, in Herb. Lugd.-Bat.; *1*, frond, × 1.5; *2*, cells, × 380; *3*, sorus, × 30.

PLATE 25

Hymenophyllum Macgillivrayi (Baker) Copeland. *Hume*, in Gray Herb.; *1*, frond, × 1.5; *2*, cells, × 380; *3*, sorus, × 30.

PLATE 26

Hymenophyllum gorgoneum Copeland sp. nov. Type, in Phil. Nat. Herb.; *1*, frond, × 1.5; *2*, cells, × 380; *3*, sorus, × 15.

PLATE 27

Hymenophyllum faejense Brackenridge. Type, in U. S. Nat. Herb.; *1*, frond, × 1; *2*, cells, × 380; *3*, sorus, × 20.

PLATE 28

Hymenophyllum praetervisum Christ. *Reinecke 88*, in U. S. Nat. Herb.; *1*, frond, × 1.5; *2*, cells, × 380; *3*, sorus, × 15.

PLATE 29

Hymenophyllum Armstrongii Kirk. *Kirk, 138*: *1*, frond, × 5; *2*, cells, × 380; *3*, sorus, old, × 30; *4*, sorus, young, in outline, × 30; *6*, sporangium, × 78.

PLATE 30

Hymenophyllum multifidum Swartz. *Rauft*, in Herb. Univ. Calif.; *1*, frond (very large), × 0.5; *2*, cells, × 380; *3*, sorus, × 15.

Hymenophyllum bivalve Swartz. *Holloway* specimen, in Herb. Univ. Calif.; *4*, pinna, × 1; *5*, sorus, × 15; *6*, cells, × 380.

PLATE 31

Hymenophyllum fuscum van den Bosch. *Copeland*, Mount Gedeh; *1*, photograph, showing fronds of typical *H. fuscum* and approximately typical *H. Zollingerianum* on the same rhizome, × 0.3; *2*, cells, × 250; *3*, sorus, × 20; *4*, sporangium, × 52.

PLATE 32

Hymenophyllum Ledermannii Brause. Cotype, from Mus. Bot. Berol.; *1*, pinna, × 3.3; *2*, cells, × 250; *3*, sorus, × 20.

PLATE 33

Hymenophyllum yelunense Rosenstock. *Ramler*, in Herb. Univ. Calif.; *1*, frond, × 0.6; *2*, cells, × 250; *3*, sorus, × 20; *4*, sporangium, × 52.

PLATE 34

Hymenophyllum laminatum Copeland. Type, in Herb. Copeland; *1*, frond, × 0.6; *2*, cross section, × 20; *3*, cells, × 250; *4*, sorus, × 20; *5*, sporangium, × 52.

PLATE 35

Hymenophyllum odontophyllum Copeland sp. nov. Type; *1*, frond, × 1; *2*, detail of rachis, × 10; *3*, detail of pinnule, × 10; *4*, sorus, × 15; *5*, cells, × 380.

PLATE 36

Hymenophyllum Baileyanum Domin. Type collection, ex Queensland Herb.; *1*, frond, × 0.6; *2* and *3*, cells, × 250; *4*, sorus, × 10.

Hymenophyllum Deplanchei Mettenius. Topotype, in Herb. Univ. Calif.; *5*, frond, × 0.6; *6*, cells, × 250; *7*, sorus, × 10.

PLATE 37

Hymenophyllum peltatum Desvaux. *Perrier de la Bathie 13758*, in U. S. Nat. Herb.; *1*, frond, × 2; *2*, cells, × 380; *3*, sorus, × 30.

PLATE 38

Hymenophyllum affine Brackenridge. Type; *1*, frond, × 2.5; *2*, cells, × 380; *3*, sorus, × 30; *4*, *Parke 20040*, frond, × 2.

PLATE 39

Hymenophyllum perfissum Copeland. Cotype, in Herb. Copeland; *1*, frond, × 2; *2*, cells, × 380; *3*, sorus, × 30; *4*, sporangium, × 78.

PLATE 40

Hymenophyllum antarcticum Presl. Cotype, in Herb. Lugd.-Bat.; *1*, frond, × 1.6; *2*, cells, × 380; *3*, sorus, × 30.

PLATE 41

Hymenophyllum Cheesemanii Baker. Probable cotype; *1*, frond, × 5; *2*, cells, × 380; *3*, sorus, × 30.

PLATE 42

Hymenophyllum tunbridgense (L.) Smith. Topotype, *U. S. Nat. Herb. 57345*; *1*, frond, × 1.6; *2*, cells, × 250; *3*, sorus, × 20; figs. 4 to 6, *H. dregeanum*, cotype, in Herb. Lugd.-Bat.; *4*, frond, × 1; *5*, cells, × 250; *6*, sorus, × 20.

PLATE 43

Hymenophyllum barbatum (van den Bosch) Baker. Type collection in Herb. Lugd.-Bat.; *1*, frond, × 2.5; *2*, cells, × 250; *3*, sorus, × 20; *4*, *Hancock 206*, in U. S. Nat. Herb., frond, × 1.

PLATE 44

Hymenophyllum simonsianum Hooker. *Henderson*, in U. S. Nat. Herb.; *1*, frond, × 1.5; *2*, cells, × 380; *3*, sorus, × 15.

PLATE 45

Hymenophyllum pumilum C. Moore. *Moore*, in U. S. Nat. Herb.; *1*, frond, × 1.5; *2*, cells, × 380; *3*, sorus, × 15.

Hymenophyllum Pumilio Rosenstock. Cotype; *4*, frond, with sorus, × 15; *5*, cells, × 100.

PLATE 46

Hymenophyllum polyanthos Swartz. Figs. 1 to 4, "*H. subdentatum* Christ." topotype, *Elmer 18014*; *1*, frond, × 1; *2*, cells, × 250; *3*, sorus, × 20; *4*, receptacle, × 20; *5* to *13*, sori, all × 20; *5*, *6*, and *6a*, *Bur. Sci. 77215*, from same frond; *7*, *Bur. Sci. 43006*, "*pseudocarum*;" *8*, *Merrill 6948*; *9*, *Bur. Sci. 82162*; *10* and *11*, *Clemens 27027* (*H. microchilum*); *12*, *Clemens 40981*; *13*, *Bur. Sci. 77216*.

PLATE 47

Hymenophyllum polyanthos Swartz. (Figs. 1 to 5, *H. gracilius* cotype, Herb. Univ. Calif.); *1* and *2*, fronds, × 0.5; *3*, cells, × 250; *4*, sorus, × 20; *5*, receptacle, × 20; *6*, lax frond, *Bur. Sci. 14945*, × 0.5; *7*, congested frond, *Bur. Sci. 16661*, × 1; figs. 8 to 10, "*H. punctisorum*;" *8*, sorus, × 20; *9*, receptacle, × 20; *10*, cells, × 250.

PLATE 48

Hymenophyllum Kuhnii Christensen. *Daubenberger*, in Herb. Univ. Calif.; *1*, frond, × 0.5; *2*, cells, × 380; *3*, sorus, × 30; *4*, receptacle, × 30.

PLATE 49

Hymenophyllum recurvum Gaudichaud. Cotype, in Phil. Nat. Herb.; *1*, frond, × 0.6; *2*, cells, × 250; *3*, sorus, × 20; *4*, receptacle, × 20.

PLATE 50

Hymenophyllum angulosum Christ. Cotype, in Phil. Nat. Herb.; *1*, frond, × 0.5; *2*, cells, × 380; *3*, sorus, × 15; *4*, receptacle, × 30.

PLATE 51

Hymenophyllum paniculiforum Presl. Cotype, in Phil. Nat. Herb.; *1*, frond, × 1; *2*, cells, × 380; *3*, sorus, × 30; *4*, receptacle, × 30; *5*, Mindanao specimen, *Bur. Sci. 38565*, cells, × 380.

PLATE 52

Hymenophyllum nitiduloides Copeland sp. nov. Type; *1*, frond, × 2; *2*, cells, × 380; *3*, sorus, × 30; *4*, receptacle, × 30.

PLATE 53

Hymenophyllum sanguinolentum Swartz. *Cheeseman*, in Herb. Univ. Calif.; *1*, frond, × 0.5; *Brame*, in U. S. Nat. Herb.; *2*, cells, × 380; *3*, sorus, × 15; *4*, sorus with cristate back, × 15; *5*, receptacle, × 30.

PLATE 54

Hymenophyllum productum Kunze. *Hort. Bog. 223, Herb. Lugd.-Bat. 50, 281–549; 1*, frond, × 0.5; *2*, cells, × 380; *3*, sorus, × 15; *4*, receptacle, × 30.

PLATE 55

Hymenophyllum Reinwardtii van den Bosch. Type, in Herb. Lugd.-Bat.; *1*, frond, × 0.5; *2*, cells, × 78; *3*, cells, × 380; *4*, sorus, × 15; *5*, receptacle, × 30.

PLATE 56

Hymenophyllum thuidium Hattrington. Cotype, in U. S. Nat. Herb.; *1*, frond, × 0.3; *2*, portion of frond, × 20; *3*, cells, × 52; *4*, cells, × 250; *5*, sorus, × 10; *6*, receptacle, × 20.

PLATE 57

Hymenophyllum samoense Baker. *Gillespie 5125*, from Fiji, in Herb. Univ. Calif.; *1*, frond, × 0.5; *2*, detail of margin, × 78; *3*, cells, × 380; *4*, sorus, × 15; *5*, receptacle, × 30.

PLATE 58

Hymenophyllum emarginatum Swartz. Type, in Herb. Swartz, Stockholm; *1*, cells, × 250; *2*, sorus, × 10; *3*, receptacle, × 20; figs. 4 to 8, "*H. eximium*," *Zollinger 258*, in Herb. Lugd.-Bat.; *4*, frond, × 0.3; *5*, cells, × 250; *6*, sorus, × 10; *7* and *8*, receptacles, × 20; figs. 9 to 11, "*H. modestum*;" *9*, sorus of type, × 20; *10*, cells of type, × 250; *11*, receptacle of cotype, in Phil. Nat. Herb., × 20.

PLATE 59

Hymenophyllum javanicum Sprengel. Figs. 1 to 4, *Palmer and Bryant 753*, from Java; *1*, frond, × 0.6; *2*, cells, × 250; *3*, sorus, × 10; *4*, receptacle, × 20; *5*, *Palmer and Bryant 851*, sorus, × 10; *6*, *Palmer and Bryant 960*, sorus, × 10; *7*, *Yates 2863*, sorus, × 10; *8*, *Yates 2698*, sorus, × 10; *9*, *Gillespie 3823*, from Fiji, sorus, × 10; all in Herb. Univ. Calif.

PLATE 60

Hymenophyllum fimbriatum J. Smith. Figs. 1 to 4, cotype, in Phil. Nat. Herb.; *1*, frond, × 0.6; *2*, cells, × 380; *3*, sorus, × 15; *4*, receptacle (of small sorus), × 30; figs. 5 to 8, involucres, × 15; *5*, *Bur. Sci. 42225*, from Rizal; *6*, *Bur. Sci. 75698*, from Albay; *7*, *Yoder s. n.*, from Panay; *8*, cotype of *H. fraternum*, from Panay.

PLATE 61

Hymenophyllum rivularense Christ. *Fenzle 1658*, in Herb. Copeland; *1*, frond, × 1; *2*, cells, × 380; *3*, sorus, dissected, × 30; *4*, receptacle, × 30.

PLATE 62

Hymenophyllum flabellatum La Billardiere. *Kerschner*, U. S. Nat. Herb.; *1*, frond, × 0.6; *2*, cells, × 380; *3*, sorus, × 15; *4*, receptacle, × 30; *5*, hair of rhizome, × 40.

PLATE 63

Hymenophyllum Le Rattii Rosenstock. *Pl. Nov. Caled. Exsic. 64*, in Phil. Nat. Herb.; *1* and *2*, fronds, × 0.6; *3*, cells, × 250; *4*, sorus, × 20; *5*, receptacle, × 20; *6*, sporangia.

PLATE 64

Hymenophyllum rarum R. Brown. Fig. 1, *Chessenna*, in Herb. Univ. Calif.; *1*, frond, × 1.5; figs. 2 to 5, *Ranft*, in Herb. Univ. Calif.; *2*, frond, × 0.5; *3*, cells, × 380; *4*, sorus, × 15; *5*, receptacle, × 15.

PLATE 65

Hymenophyllum involucratum Copeland. Type collection; *1*, frond, × 1.3; *2*, cells, × 250; *3*, sorus, × 20; *4*, receptacle, × 20.

PLATE 66

Hymenophyllum Walleri Maiden and Betche. Type, in Queensland Herb.; *1*, frond, × 2; *2*, cells, × 380; *3*, sorus, × 15; *4*, receptacle, × 30.

PLATE 67

Hymenophyllum minoides Baker. *Franc*, in Herb. Univ. Calif.; *1*, frond, × 3; *2*, cells, × 380; *3*, sorus, × 15; *4*, receptacle, × 30.

PLATE 68

Hymenophyllum montanum Kirk. Probable cotype, in U. S. Nat. Herb.; *1*, frond, × 1.5; *2*, cells, × 380; *3*, sorus, × 30; *4*, receptacle, × 30.

PLATE 69

Hymenophyllum fumarioides Baker. *Wright*, in Herb. Lugd.-Bat.; *1*, frond, × 1; *2*, cells, × 250; *3*, sorus, × 10; *4*, receptacle, × 20; *5* and *6*, "*H. parvum*," *Perrier 18377*, in U. S. Nat. Herb., fronds, × 3.

PLATE 70

Hymenophyllum imbricatum Blume. *1* and *2*, "*H. bamlerianum*," cotype, *Bamler S 50*, sorus and receptacle, × 20; *3* and *4*, *Bamler 50*, sorus and receptacle, × 20; figs. 5 to 9, "*H. imbricatum*" in Herb. Lugd.-Bat.; *5* to *8*, receptacles, × 20; *9*, sporangium, × 52.

PLATE 71

Hymenophyllum imbricatum Blume. "*H. formosum*," type, *1*, frond, × 0.3; *2*, cells, × 250; *3*, sorus, × 20; *4*, receptacle, × 20; *5*, sporangium, × 52; *6* to *8*, receptacles, × 20.

PLATE 72

Hymenophyllum Treubii Raciborski. *Raciborski*, in Phil. Nat. Herb.; *1*, frond, × 1; *2*, cells, × 250; *3*, sorus, × 20; *4*, receptacle, × 20.

PLATE 73

Hymenophyllum Junghuhnii van den Bosch. Eligible type; *1*, small frond, × 0.3; *2*, cells, × 250; *3*, sorus, × 20; *4*, receptacle, × 20; *5* and *6*, receptacles of Javan specimens, × 20; *7*, sporangium, × 52.

PLATE 74

Hymenophyllum longifolium v. A. van Rosenburgh. *Brass 1467*, in Herb. Copeland; *1*, frond, × 0.3; *2*, cells, × 250; *3*, sorus, × 20; *4*, receptacle, × 20.

PLATE 75

Hymenophyllum salakense Raciborski. Figs. 1 and 2. *Raciborski*, in Phil. Nat. Herb.; *1*, frond, × 0.3; *2*, cells, × 250; *3*, topotype, *Bakh van den Brink*, in Herb. Univ. Calif., sorus, × 20; *4*, receptacle, × 20.

PLATE 76

Hymenophyllum badium Hooker and Greville. Figs. 1 to 4, *Cuming 130*, cotype of *Sphaerocionium macrocarpum*, in Phil. Nat. Herb.; *1*, frond, × 0.3; *2*, cells, × 250; *3*, sorus, × 20; *4*, receptacle, × 20; *5*, mature, and *5a*, young, receptacles, *Bur. Sci. 3548*, from the Batanes; *6*, *Bur. Sci. 8333*, near Manila; *7* to *9*, *Pételot 3905*, from Tonkin.

PLATE 77

Hymenophyllum crispatum Wallich. *Bur. Sci. 5443 Ramos*, in Phil. Nat. Herb.; *1*, frond, × 0.5; *2*, cells, × 380; *3*, sorus, × 15; *4*, receptacle, × 30.

PLATE 78

Hymenophyllum crispatum, illustrated by typical *H. pleiocarpum*, *Bünnemeyer 9245*, in Herb. Lugd.-Bat.; *1*, frond, × 0.5; *2*, cells, × 380; *3*, sorus, × 15; *4*, receptacle, × 30.

PLATE 79

Hymenophyllum crispato-alatum Hayata. *Faurie 627*, in Phil. Nat. Herb.; *1*, frond, × 0.5; *2*, cells, × 380; *3*, sorus, × 30; *4*, receptacle, × 30.

PLATE 80

Hymenophyllum flexile Makino. *Tagawa 242*, in Phil. Nat. Herb.; *1*, frond, × 0.3; *2*, cells, × 250; *3*, sorus, × 20; *4*, receptacle, × 20.

PLATE 81

Hymenophyllum opacum Copeland sp. nov. Type; *1*, frond, × 0.3; *2*, cells, × 250; *3*, sorus, × 20; *4*, receptacle, × 20.

PLATE 82

Hymenophyllum Wrightii van den Bosch. Figs. 1 to 3, cotype, in U. S. Nat. Herb.; *1*, frond, × 3; *2*, cells, × 380; *3*, sorus, × 30; figs. 4 and 5, *Taquet*, in Herb. Copeland; *4*, fronds, × 1.5; *6*, receptacle, × 30.

PLATE 83

Hymenophyllum exsertum Wallich. *Mann*, in U. S. Nat. Herb.; *1*, frond, × 0.5; *2*, cells, × 380; *3*, sorus, × 30; *4*, receptacle, × 20.

PLATE 84

Hymenophyllum flexuosum A. Cunn. *Setchell*, in Herb. Univ. Calif.; *1*, frond, × 0.5; *2*, cells, × 380; *3*, sorus, × 30; *4*, receptacle, × 30.

PLATE 85

Hymenophyllum australe Willdenow. *Gunn*, in U. S. Nat. Herb.; *1*, frond, × 0.5; *2*, cells, × 380; *3*, sorus, × 30; *4*, receptacle, × 30.

PLATE 86

Hymenophyllum demissum Swartz. Figs. 1, 2, 4, and 9, *Brame*, in U. S. Nat. Herb.; fig. 3, *Kirk*. *1*, Frond, × 0.3; *2* and *3*, pinnæ, × 0.3; *4*, cells, showing double margin, × 250; *5*, sorus, × 10; *6*, receptacle, × 20; *7* to *10*, double sori, × 20.

PLATE 87

Hymenophyllum dilatatum Swartz. Figs. 1 to 3 and 5 to 8, *Setchell*, Herb. Univ. Calif.; *1*, frond, × 0.3; *2*, cells, × 250; *3*, cells, surface layer in solid lines, middle layer in broken lines, bottom layer in dotted lines, × 50; *4*, section, by van den Bosch, × 35; *5*, sorus, × 20; figs. 6 to 9, receptacles, × 20; *9*, from *Brackenridge* specimen, in U. S. Nat. Herb.

PLATE 88

Hymenophyllum scabrum A. Richard. *Checkeman*, in U. S. Nat. Herb.; *1*, frond, × 0.5; *2*, hairs, at base of stipe, × 15; *3*, sorus, × 30; *4*, receptacle, × 20; *5*, drawing by van den Bosch, in Herb. Lugd.-Bat., of cross section of lamina, × 65.

PLATE 89

Hymenophyllum marginatum Hooker and Greville. *Watts*, in U. S. Nat. Herb.; *1*, frond, × 4.5; *2*, cells, × 380; *3*, sorus, × 30; *4*, receptacle, × 30.

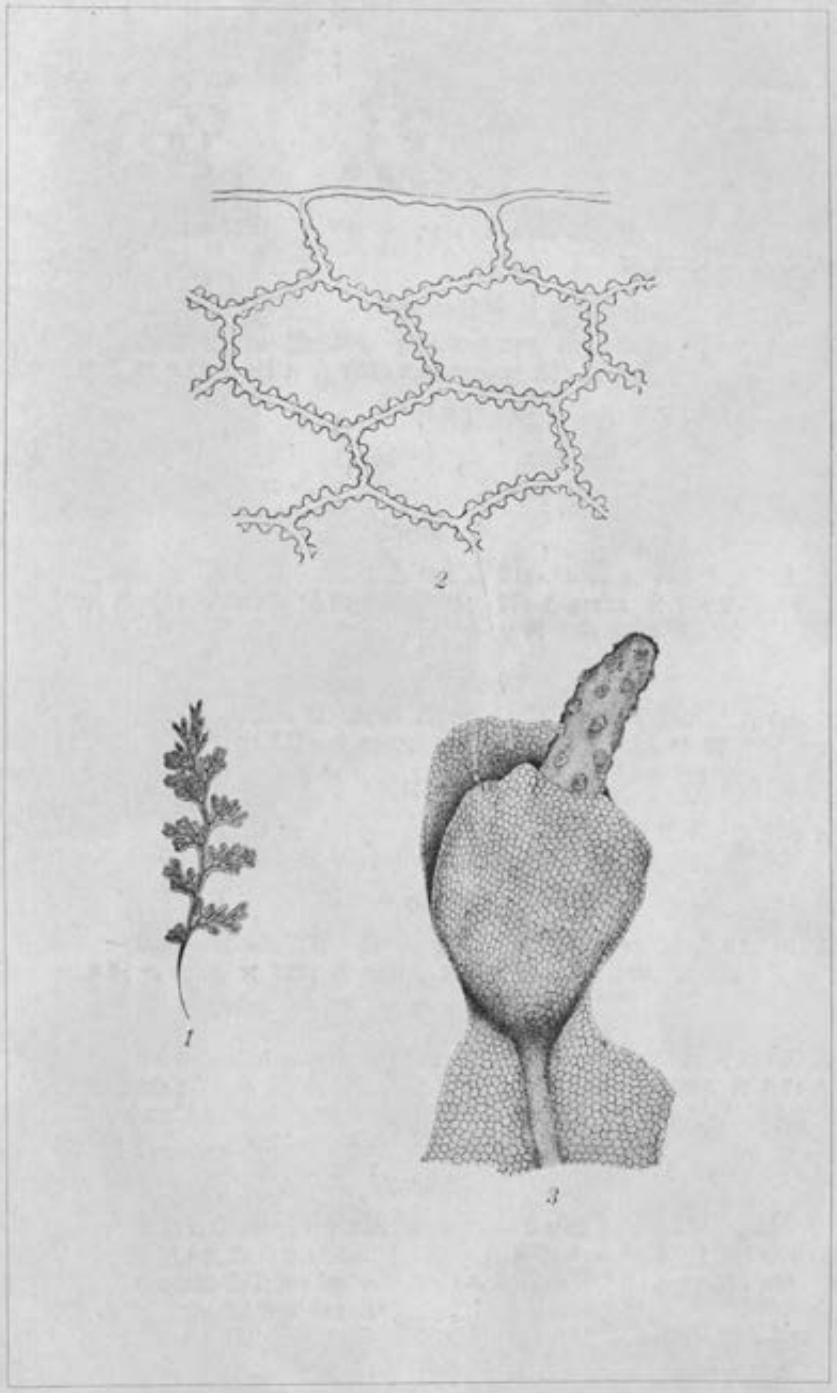
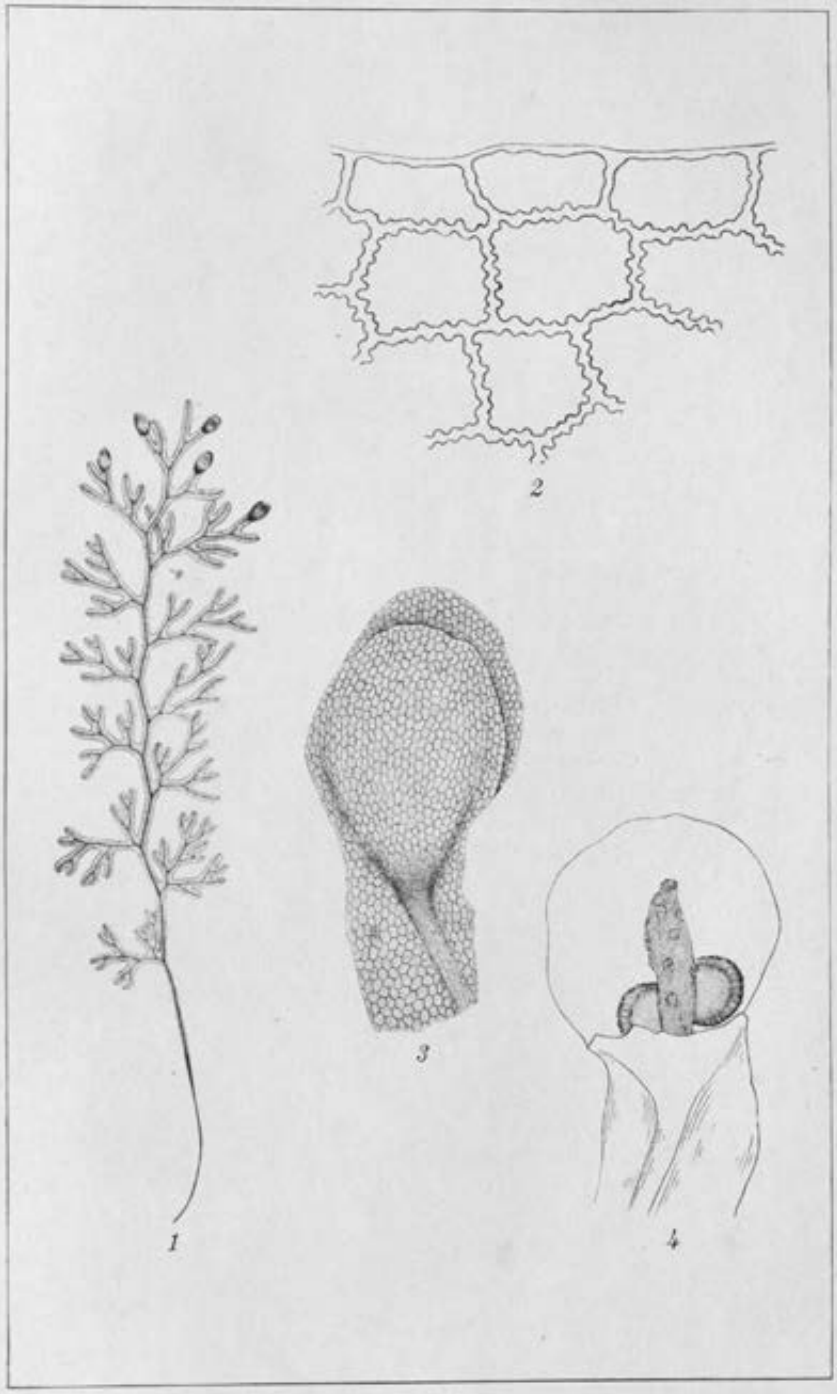


PLATE 1.



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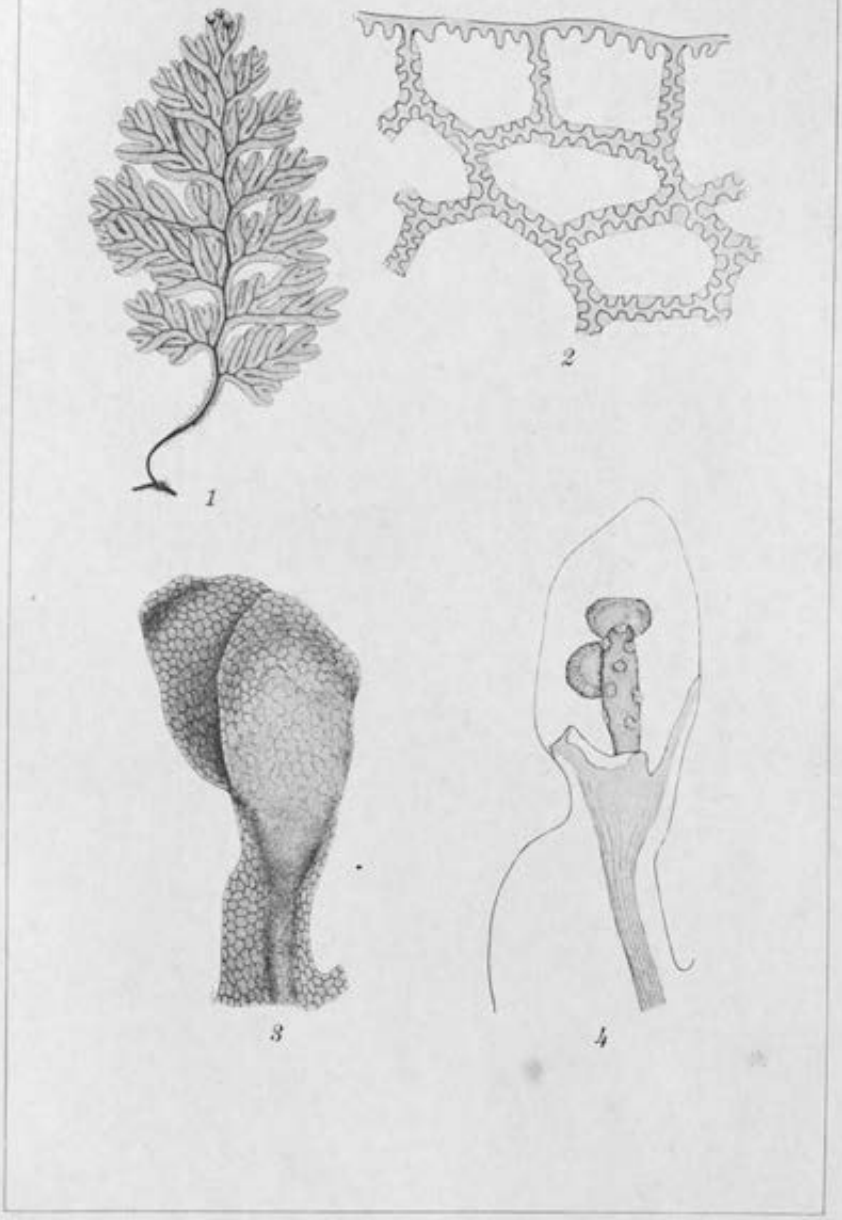

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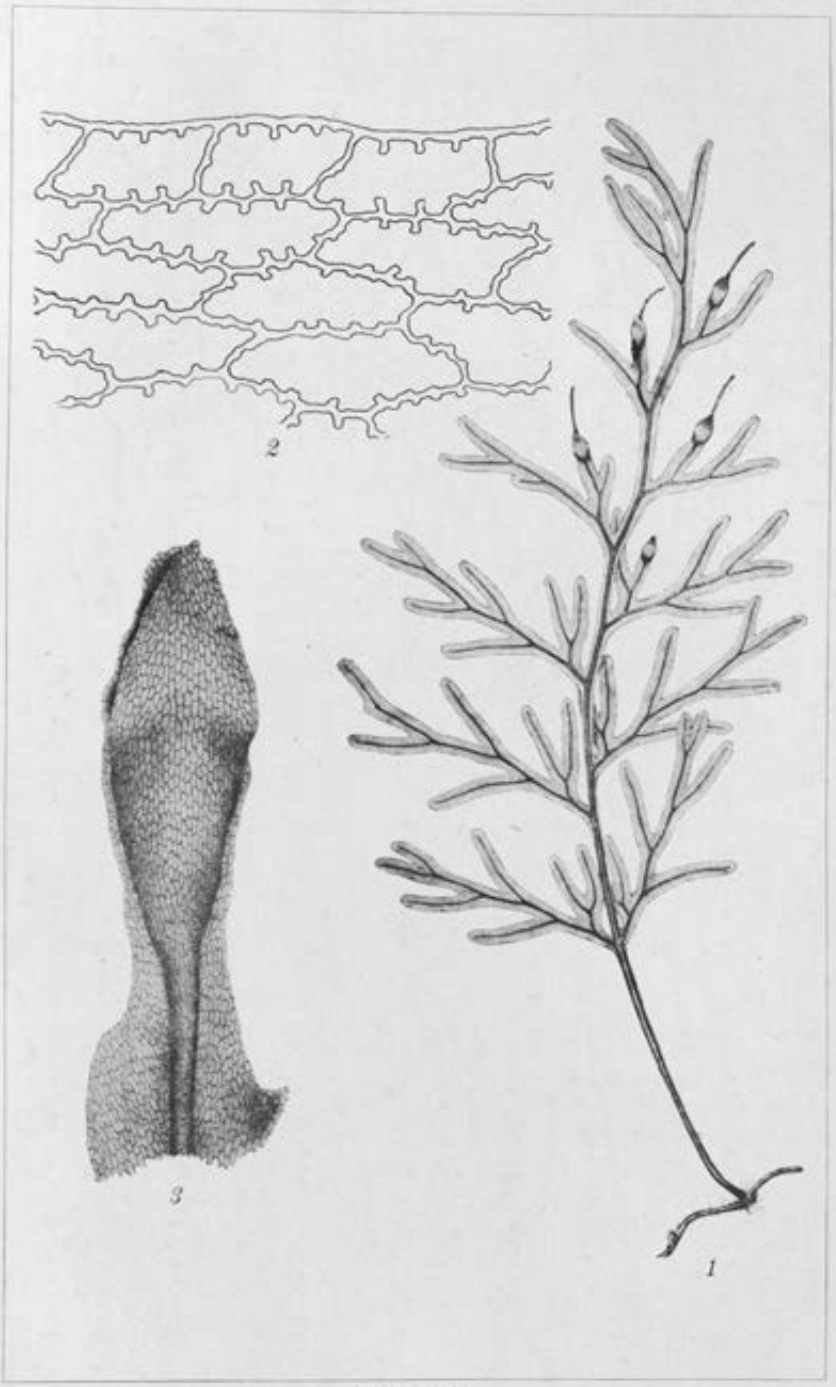

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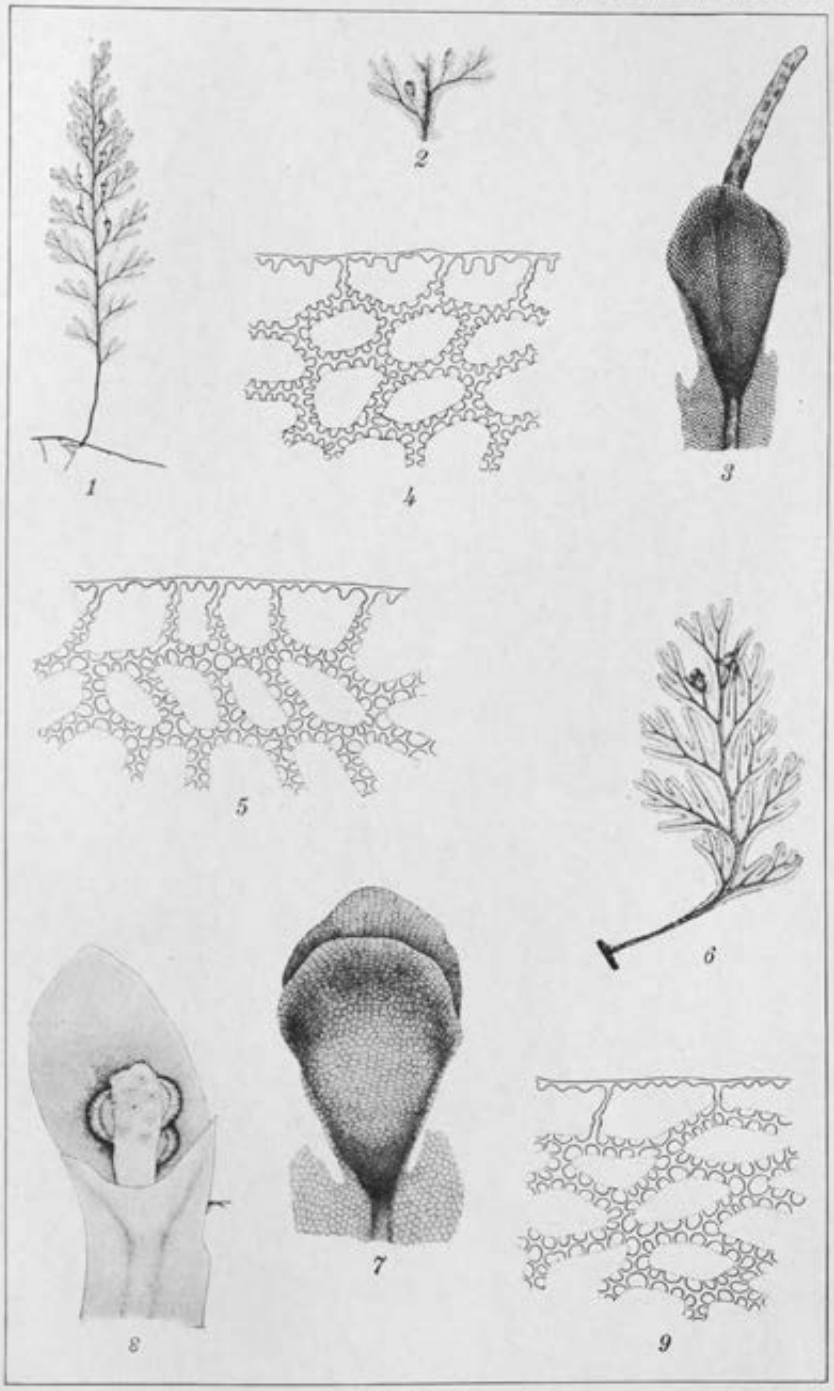
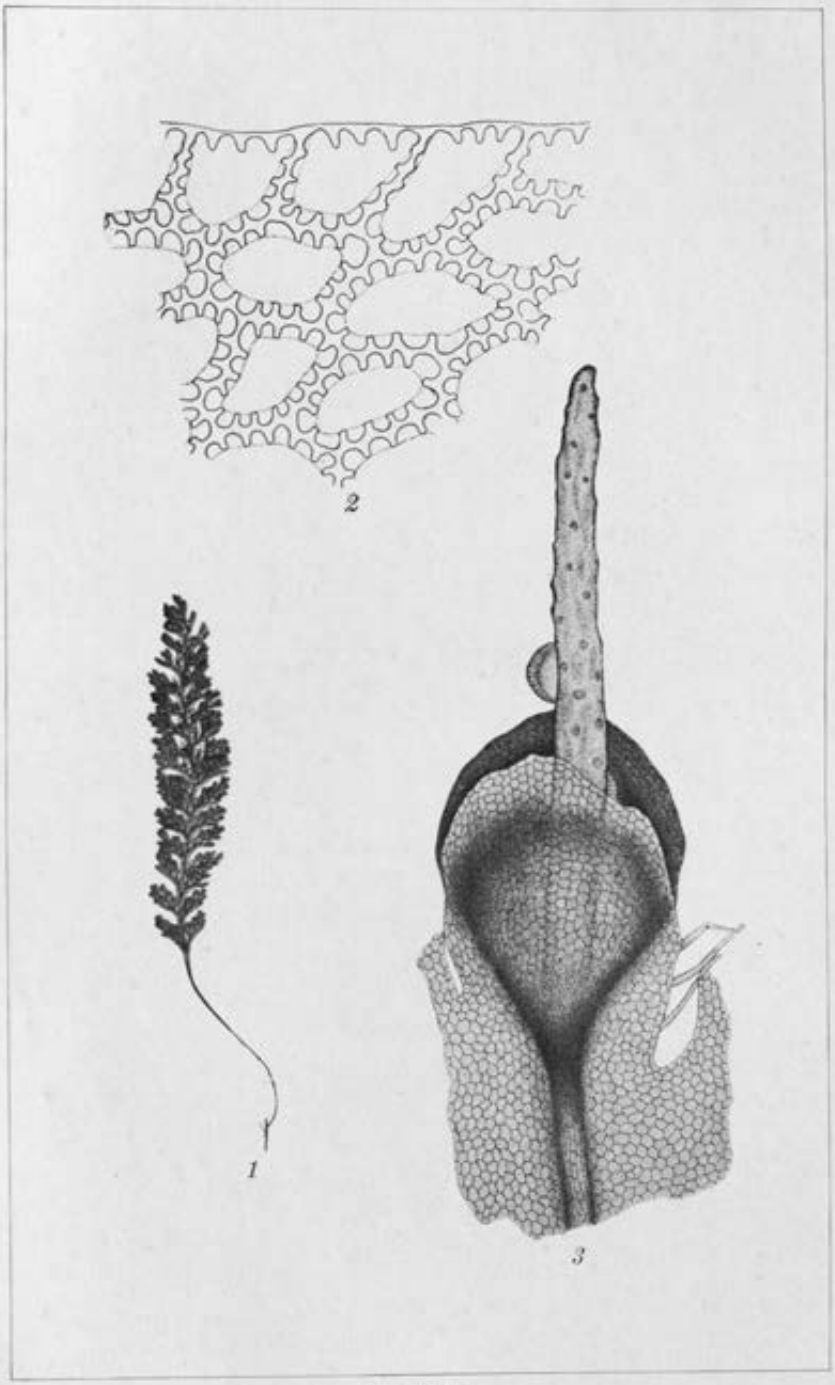


PLATE 5.



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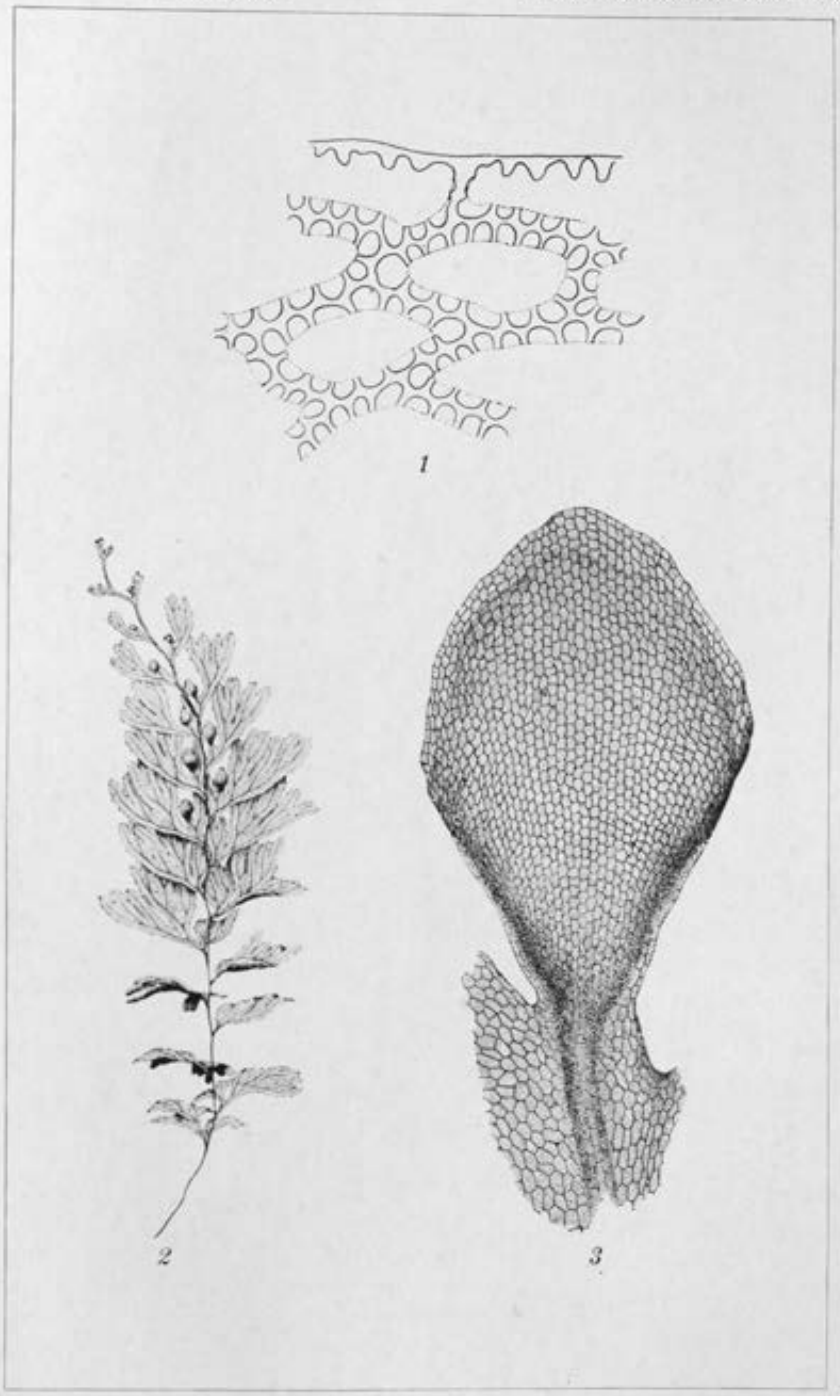

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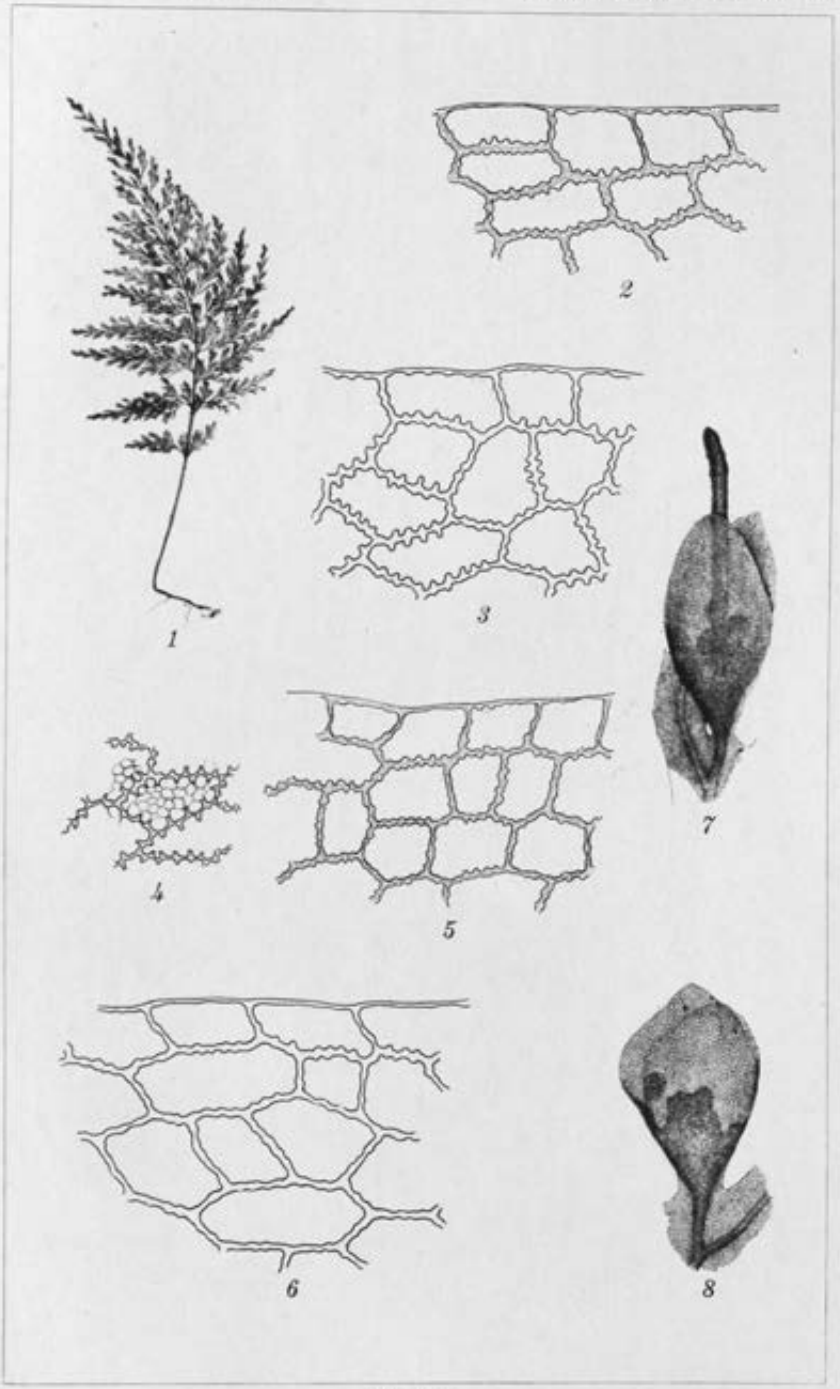

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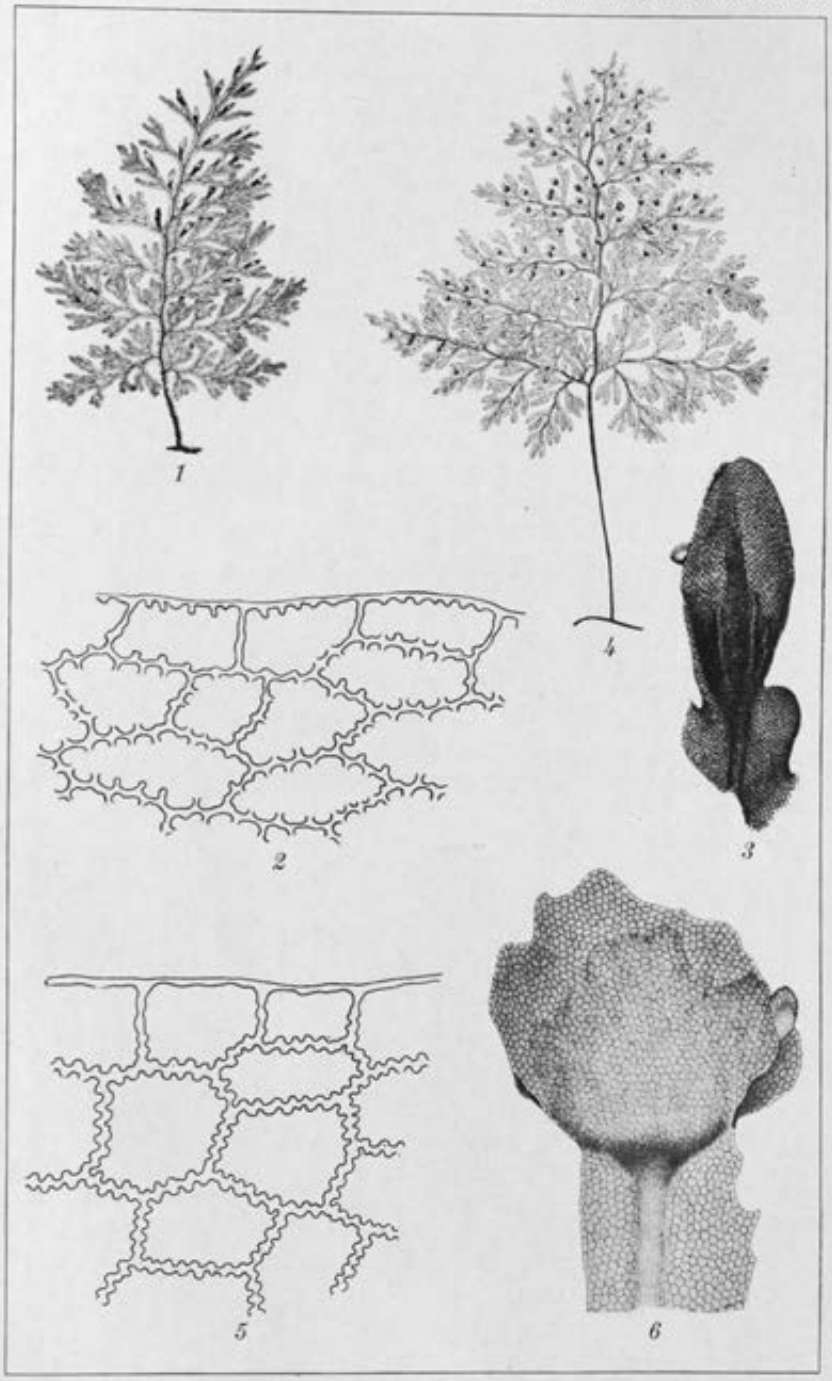

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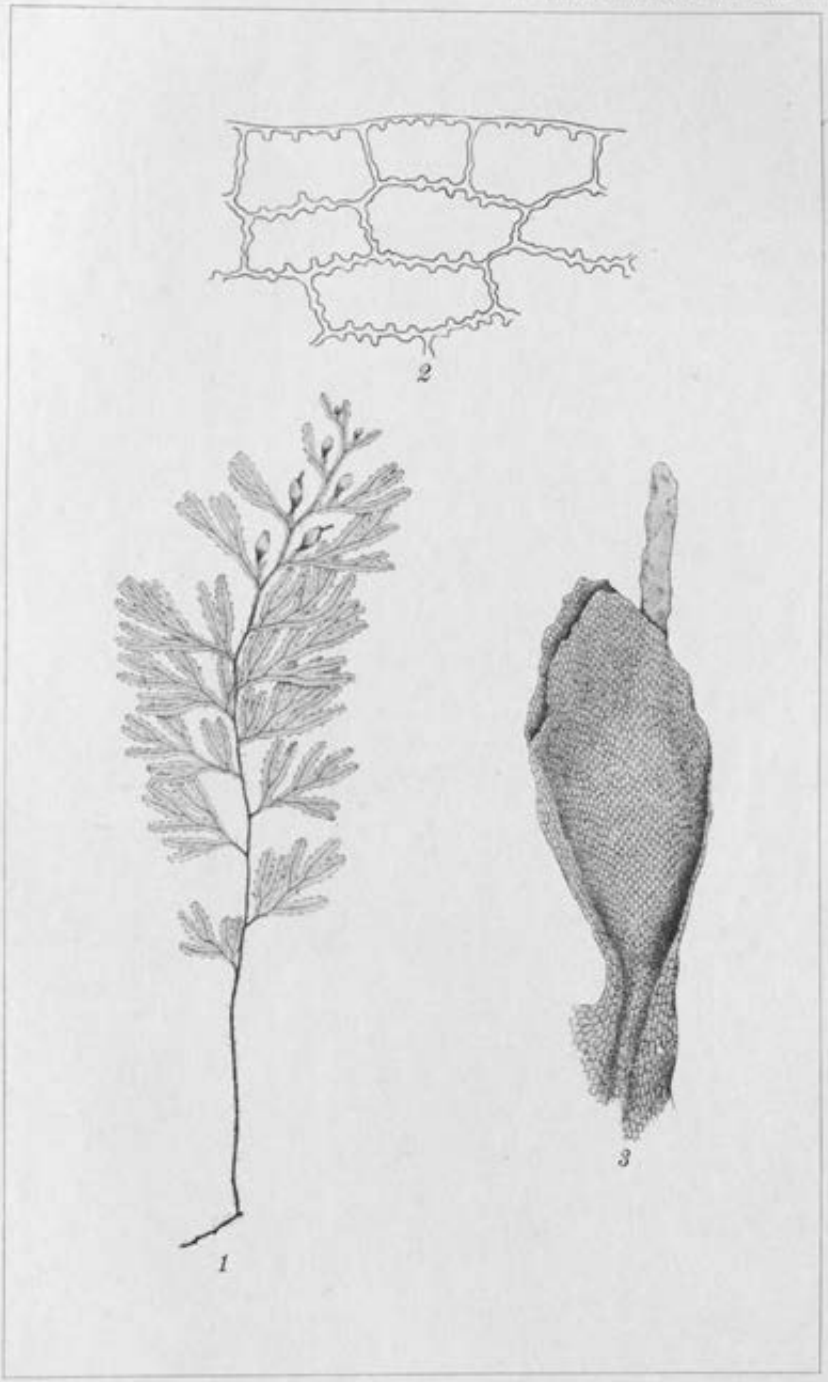

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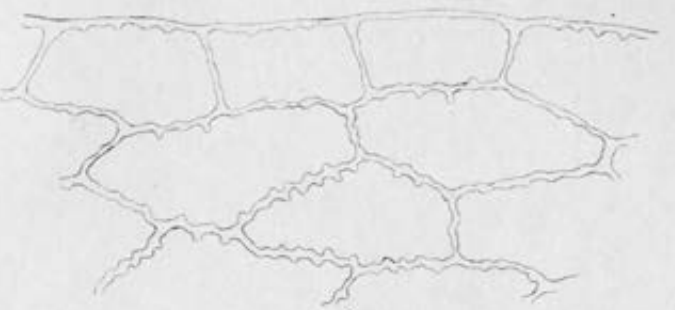

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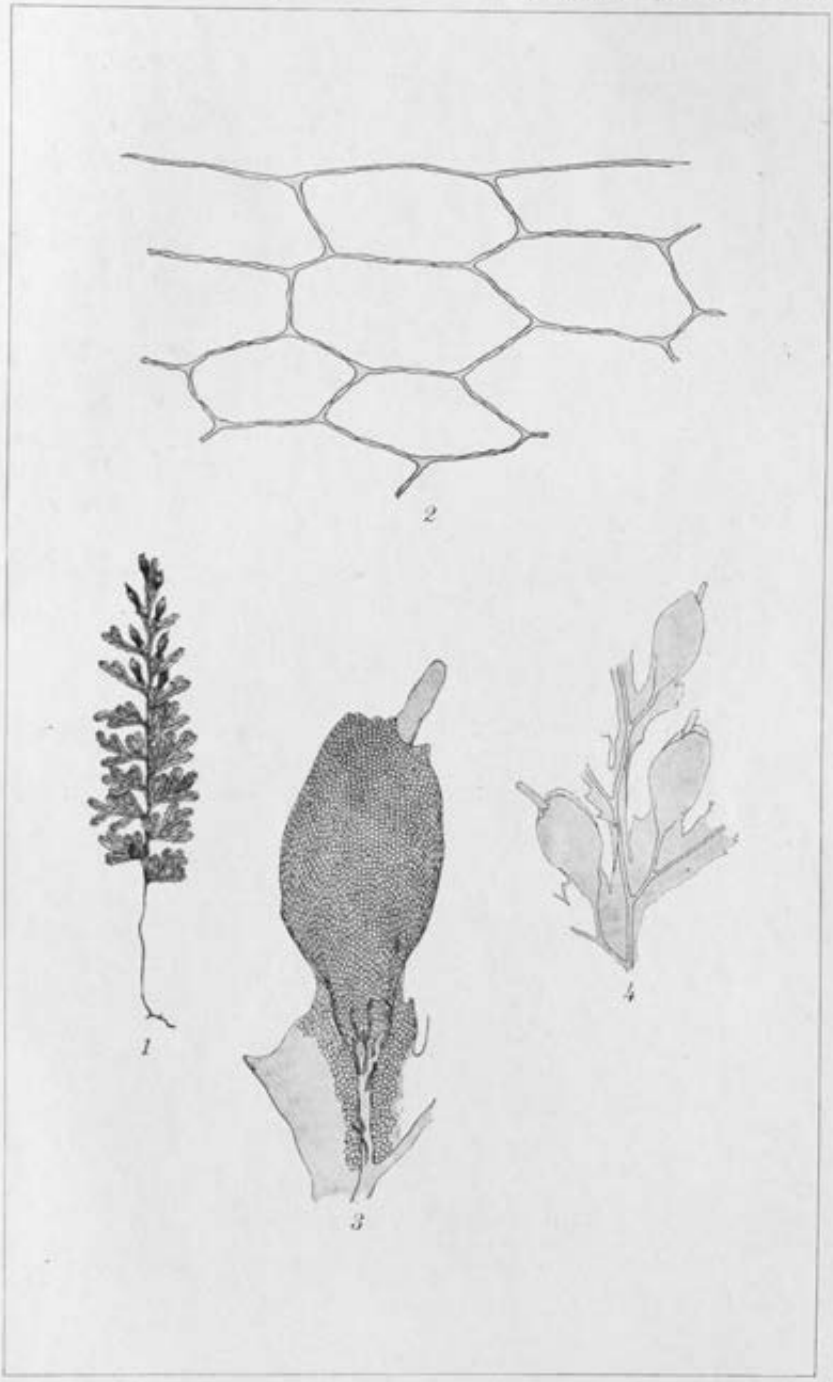

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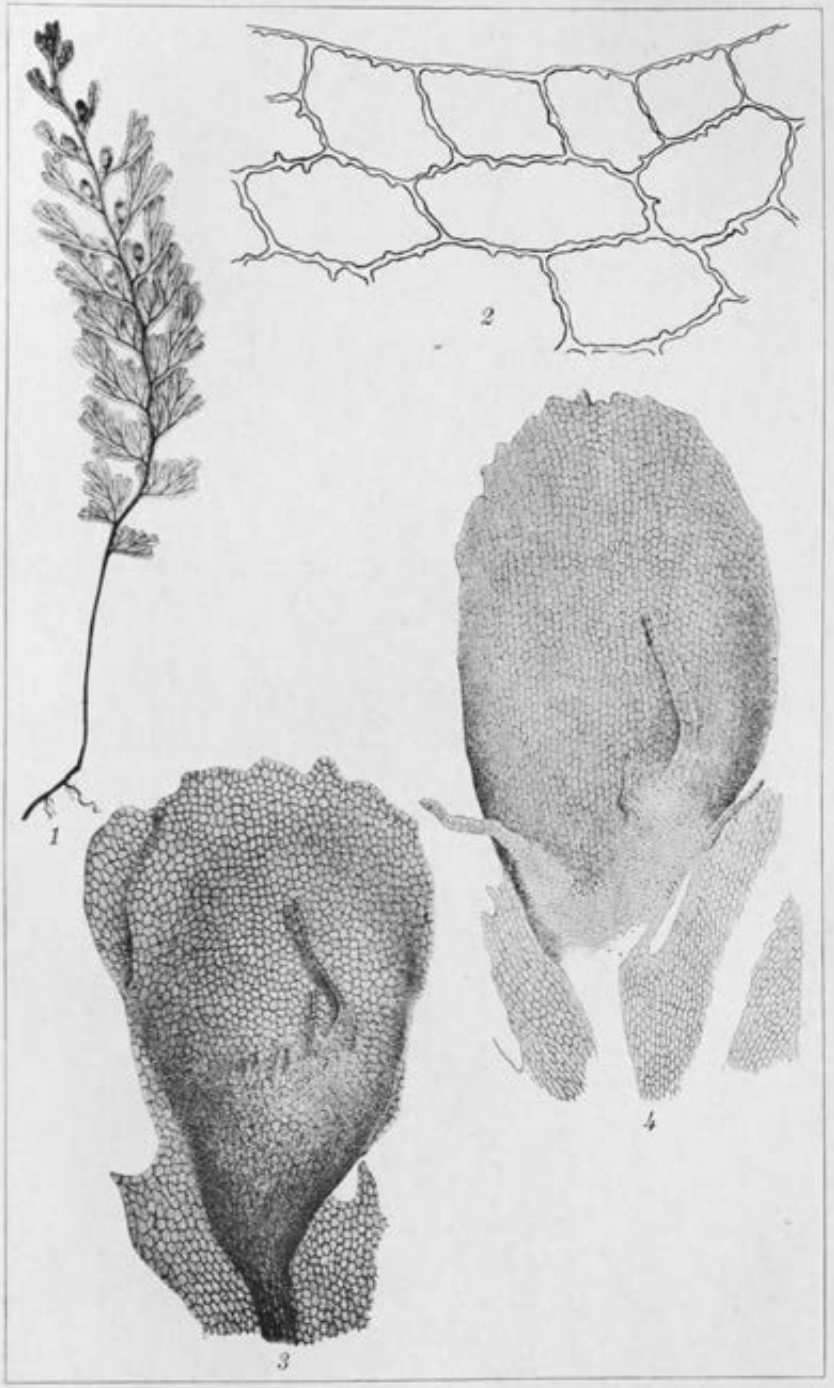

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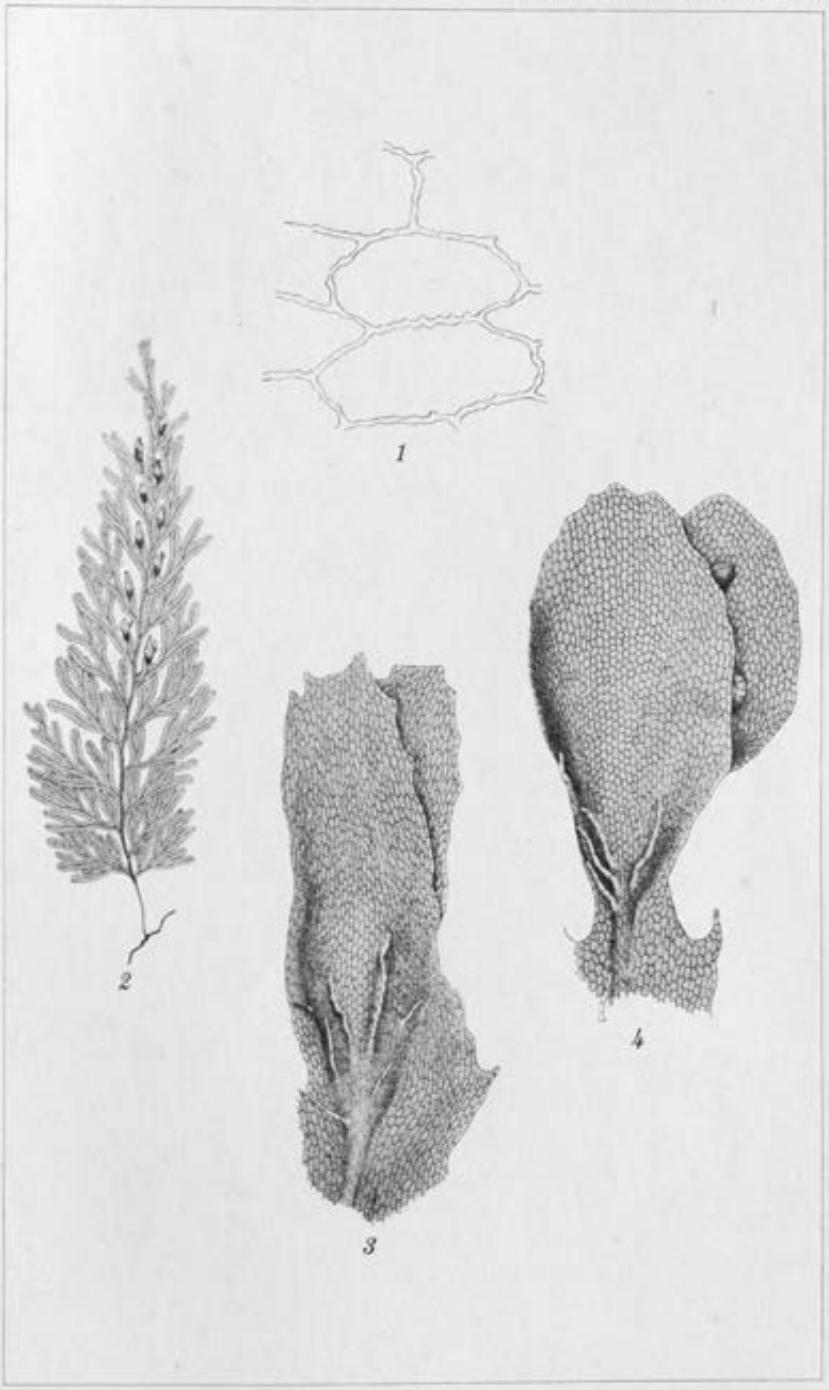

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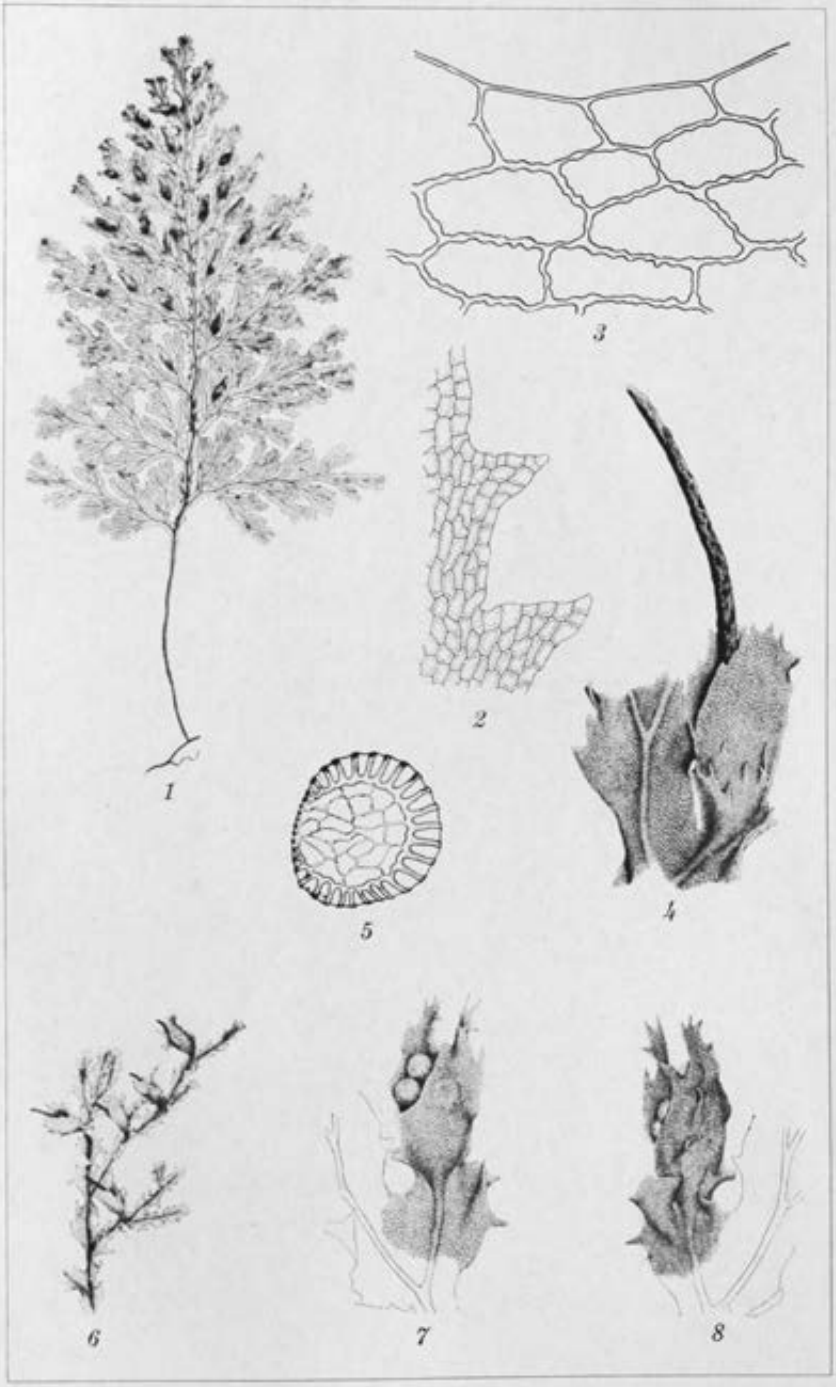

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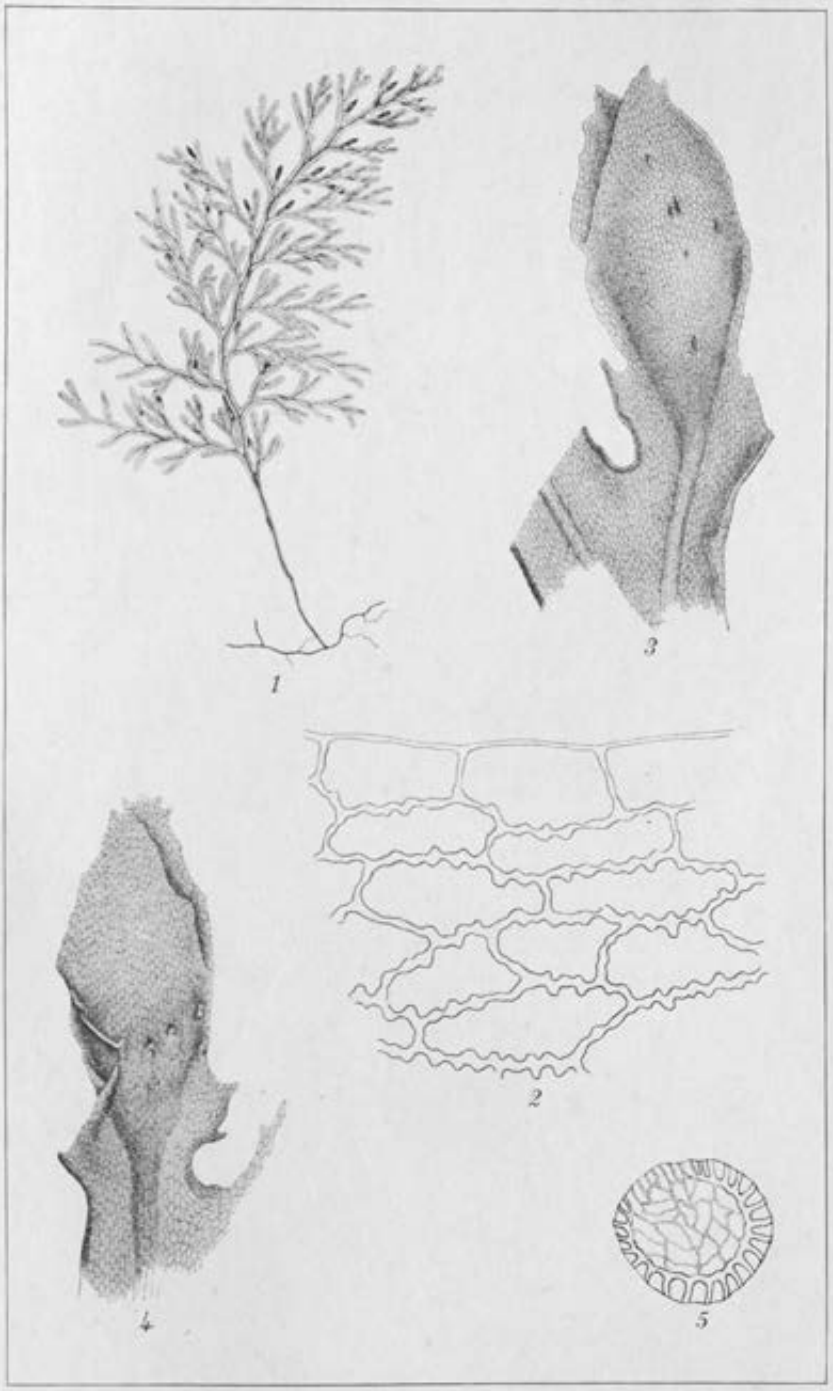

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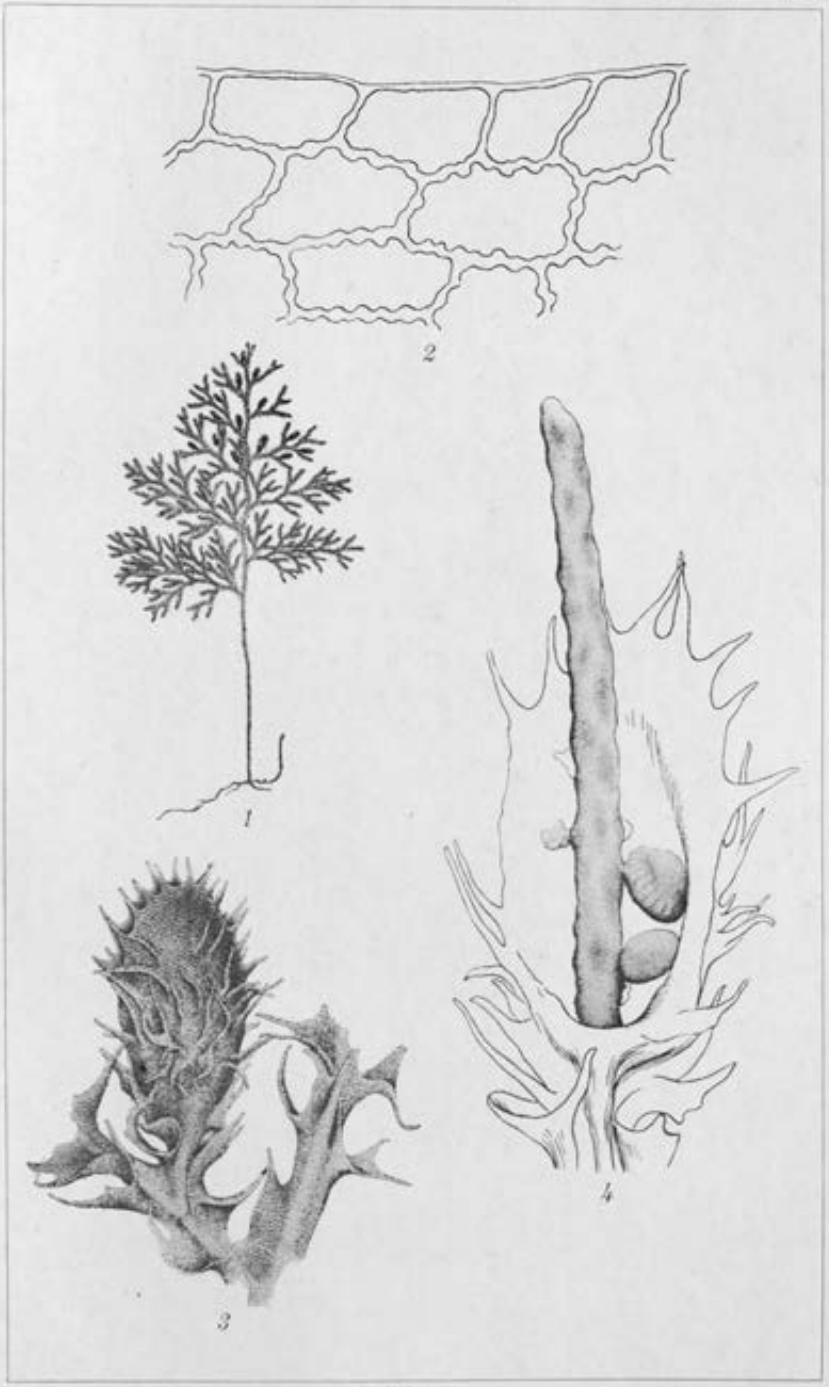

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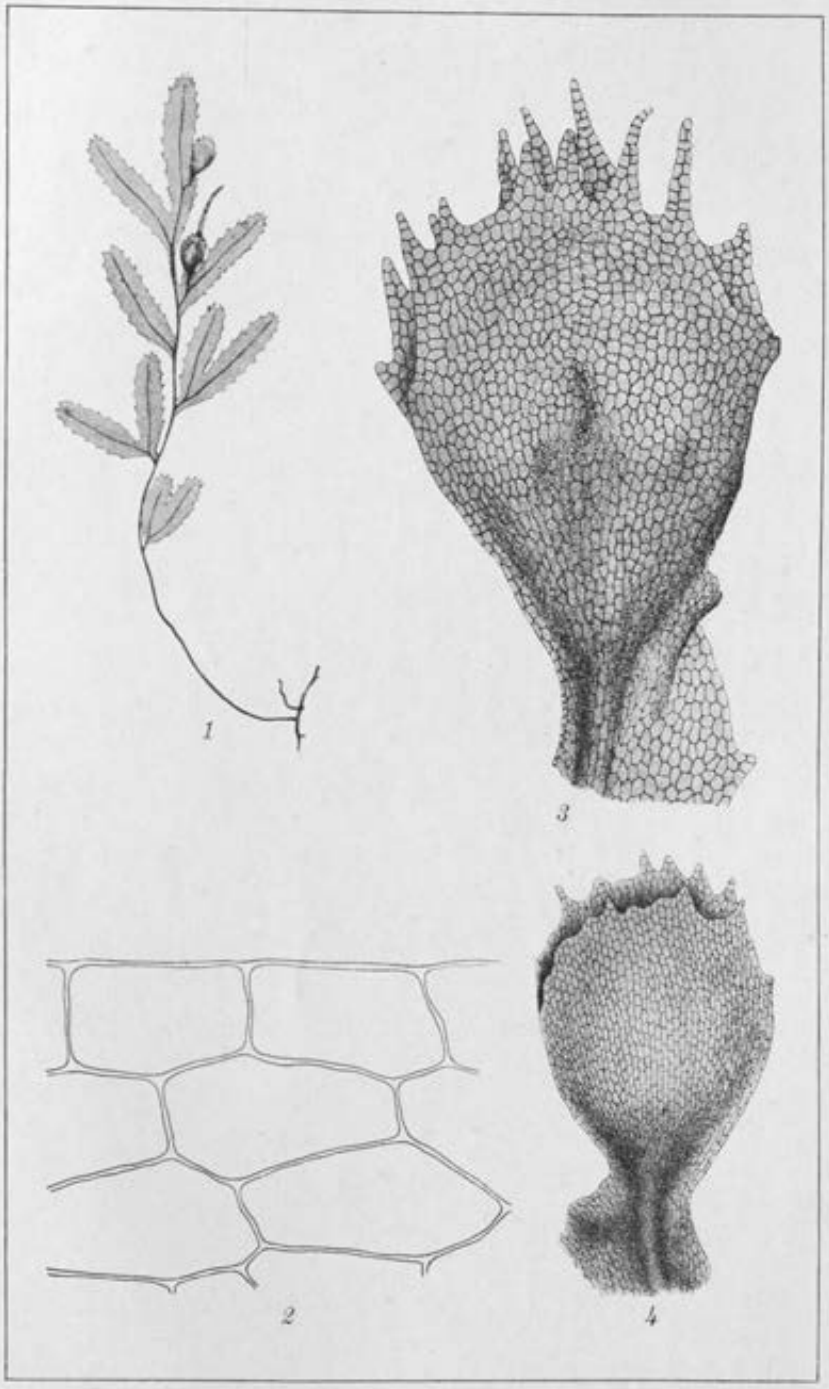

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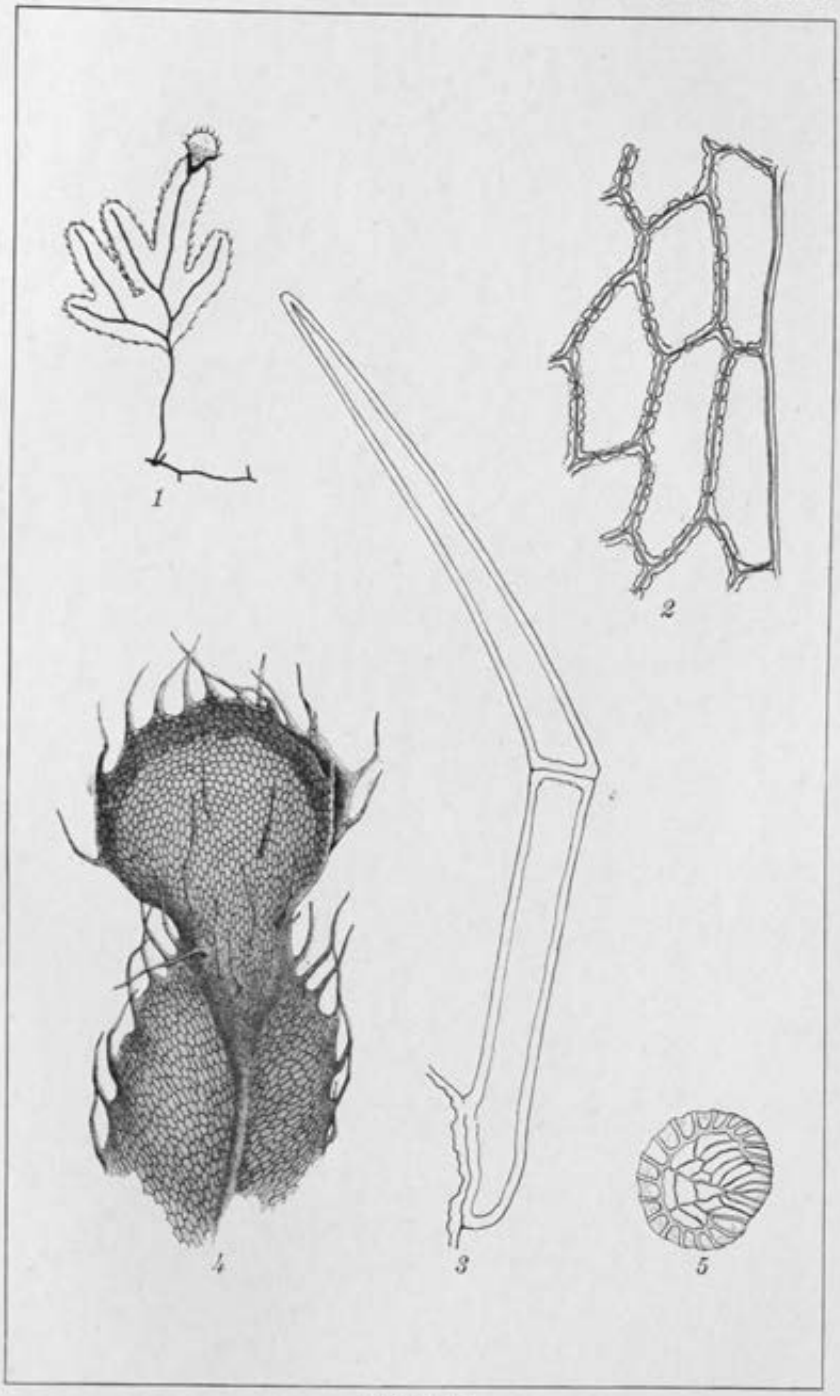

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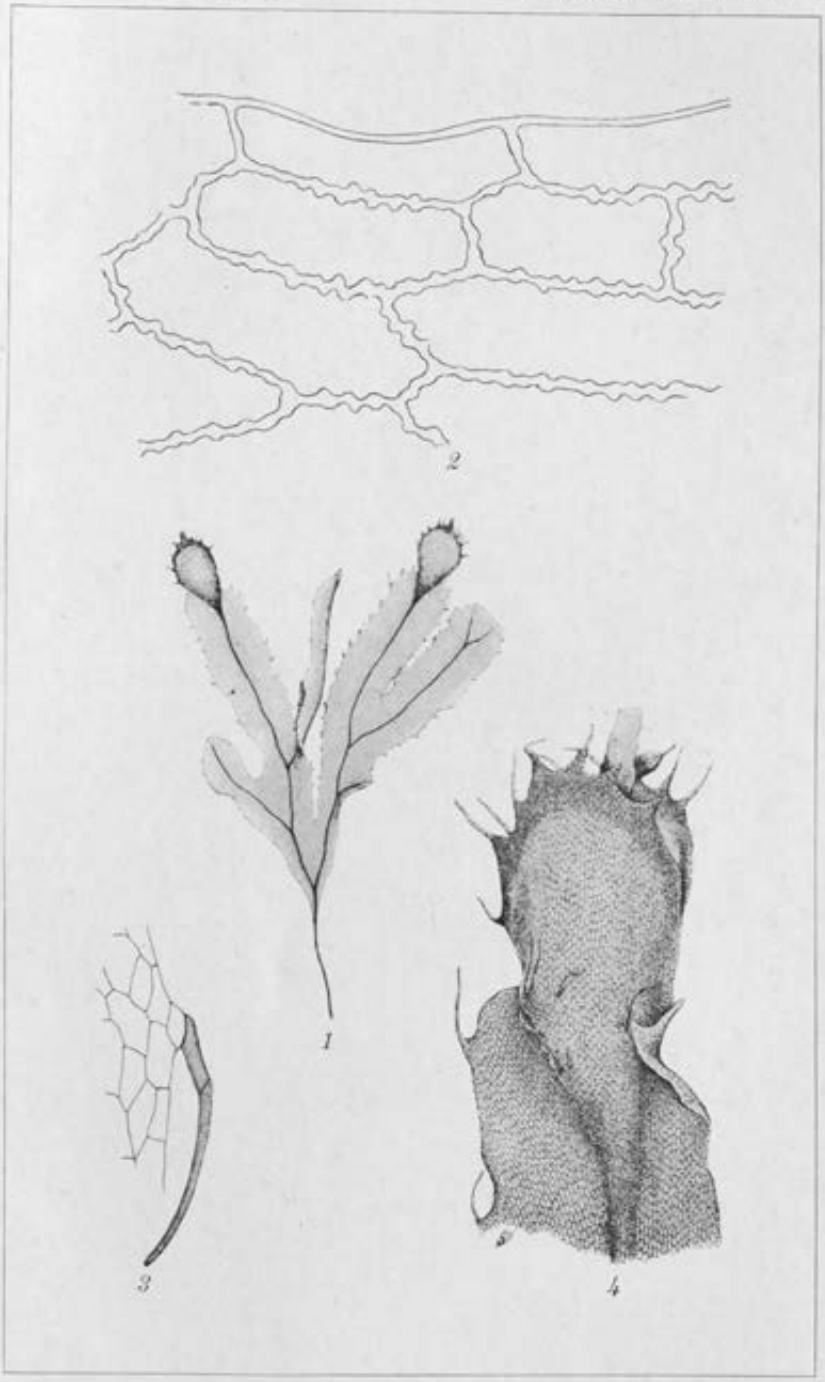

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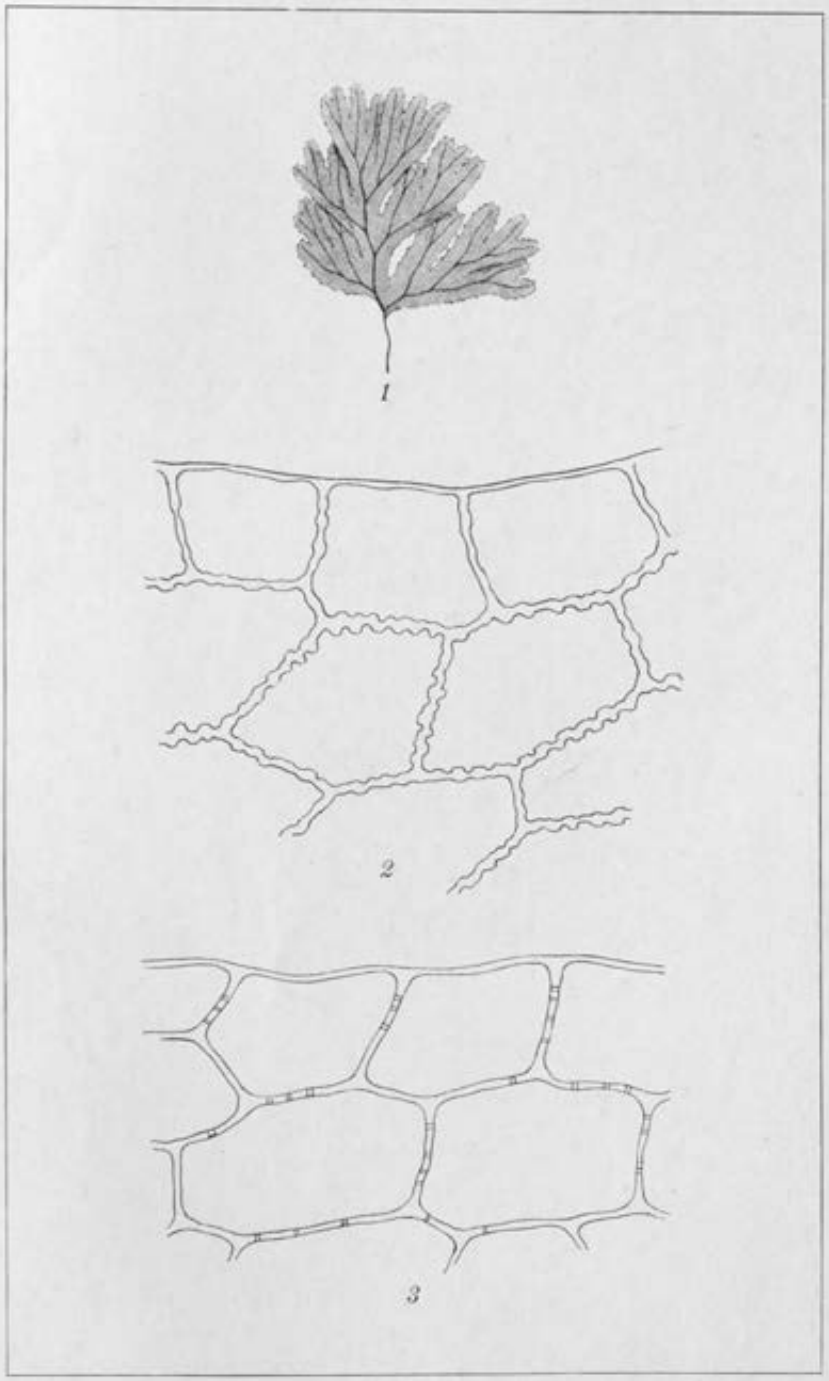

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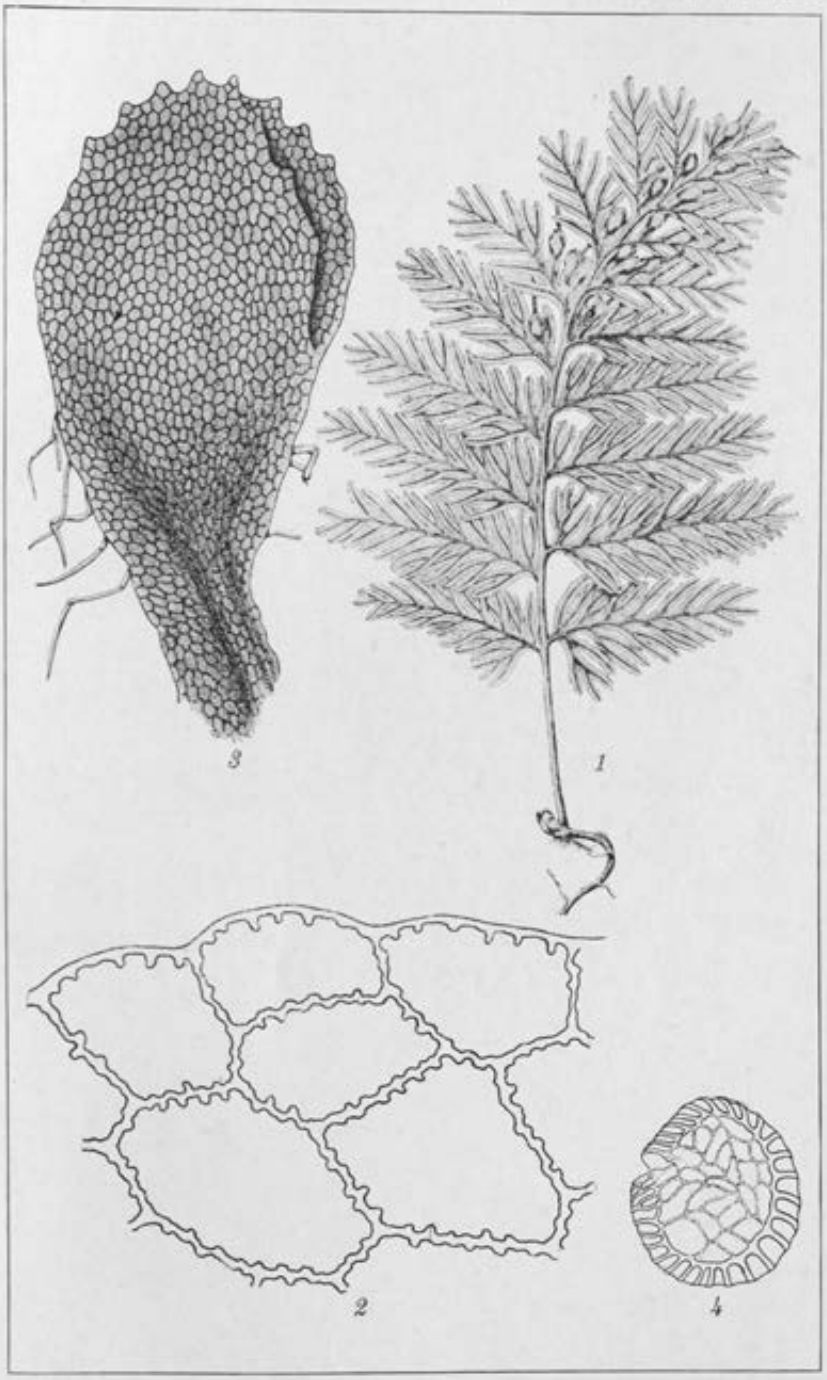

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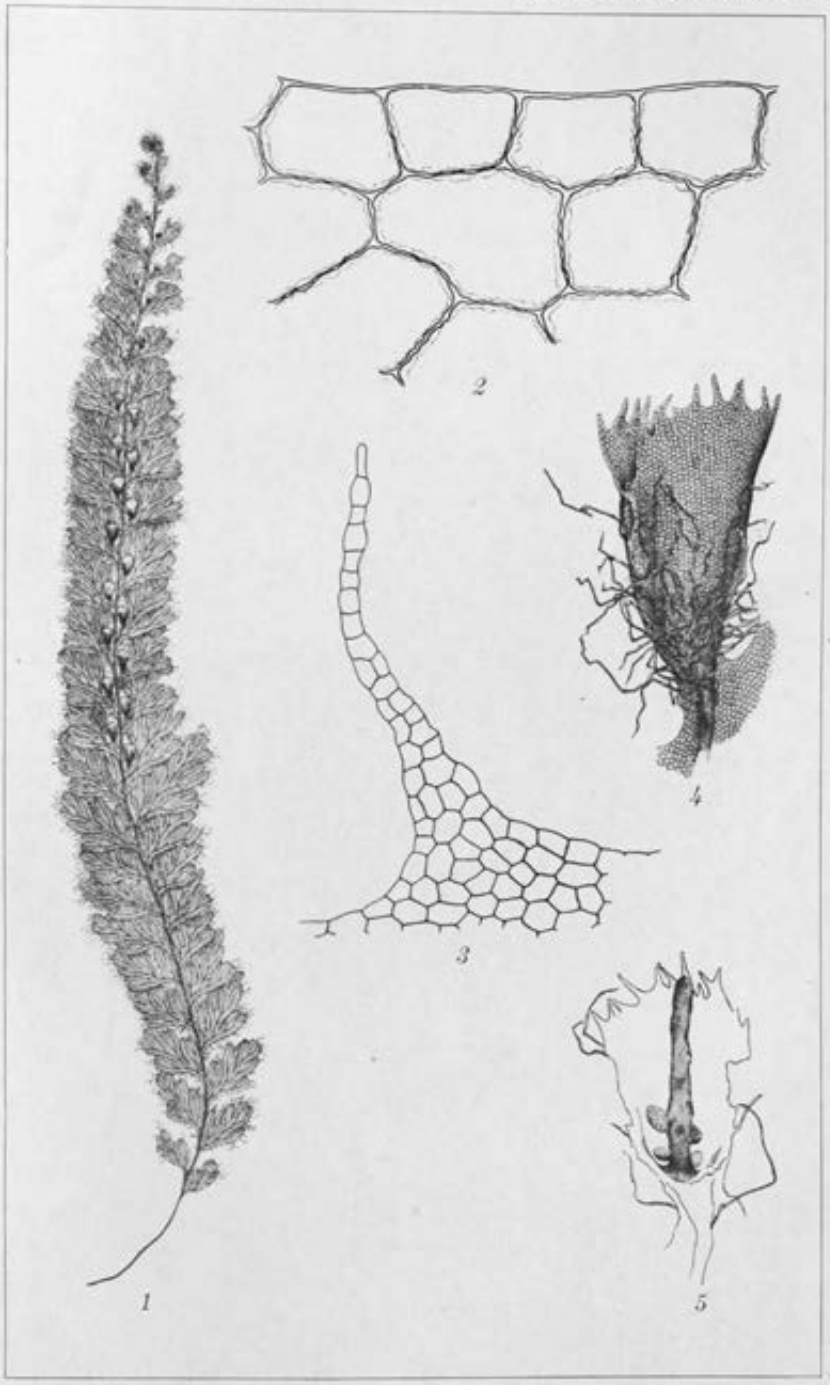

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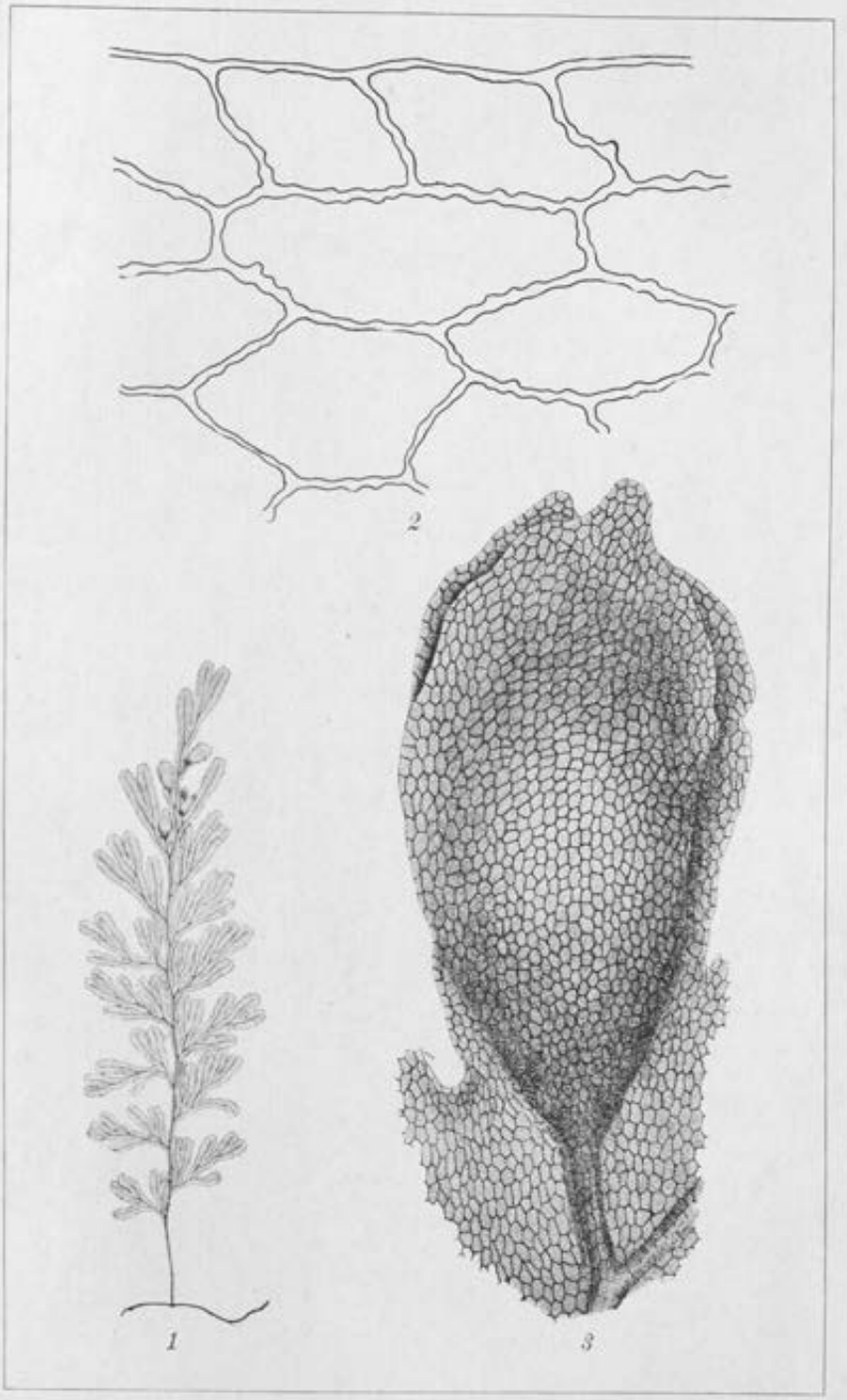

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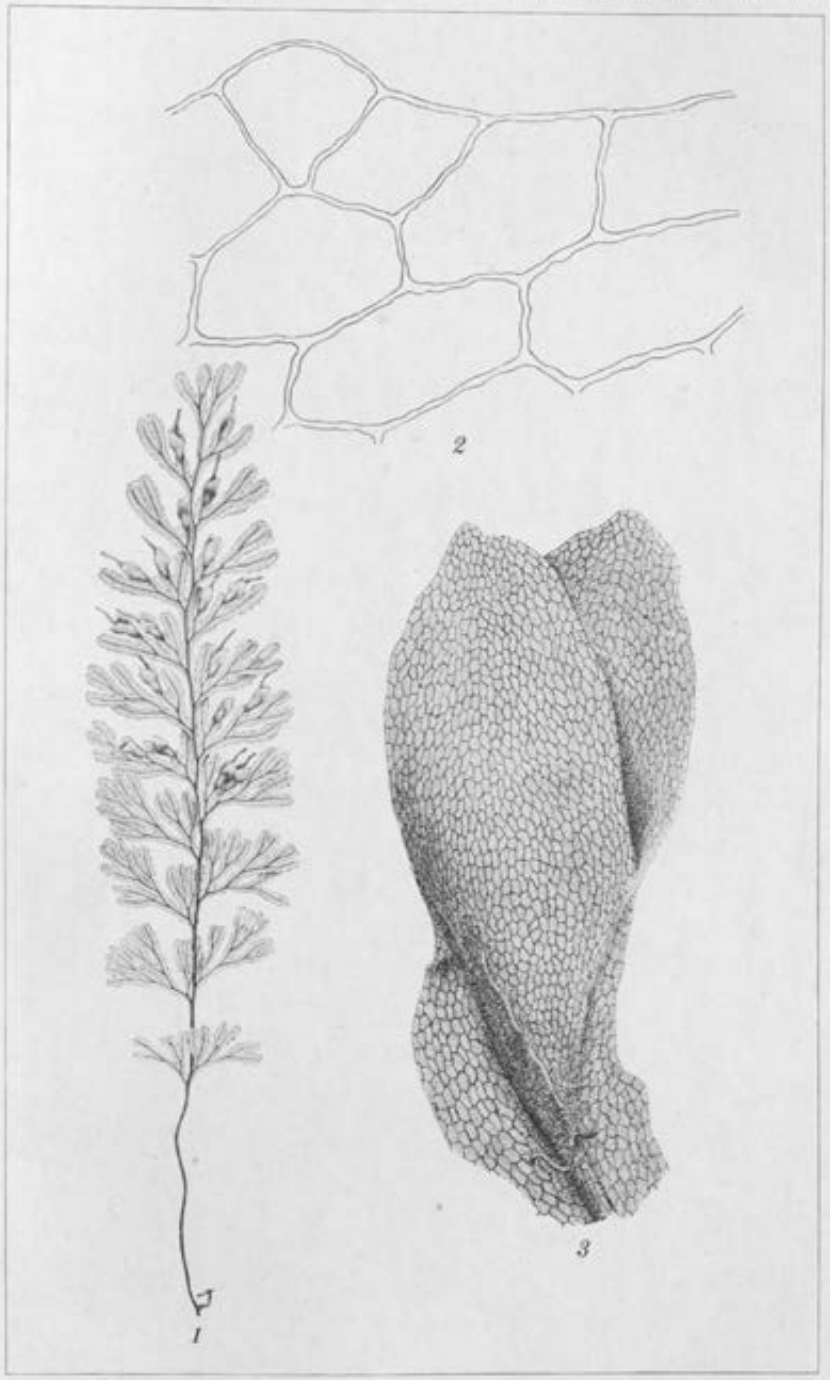

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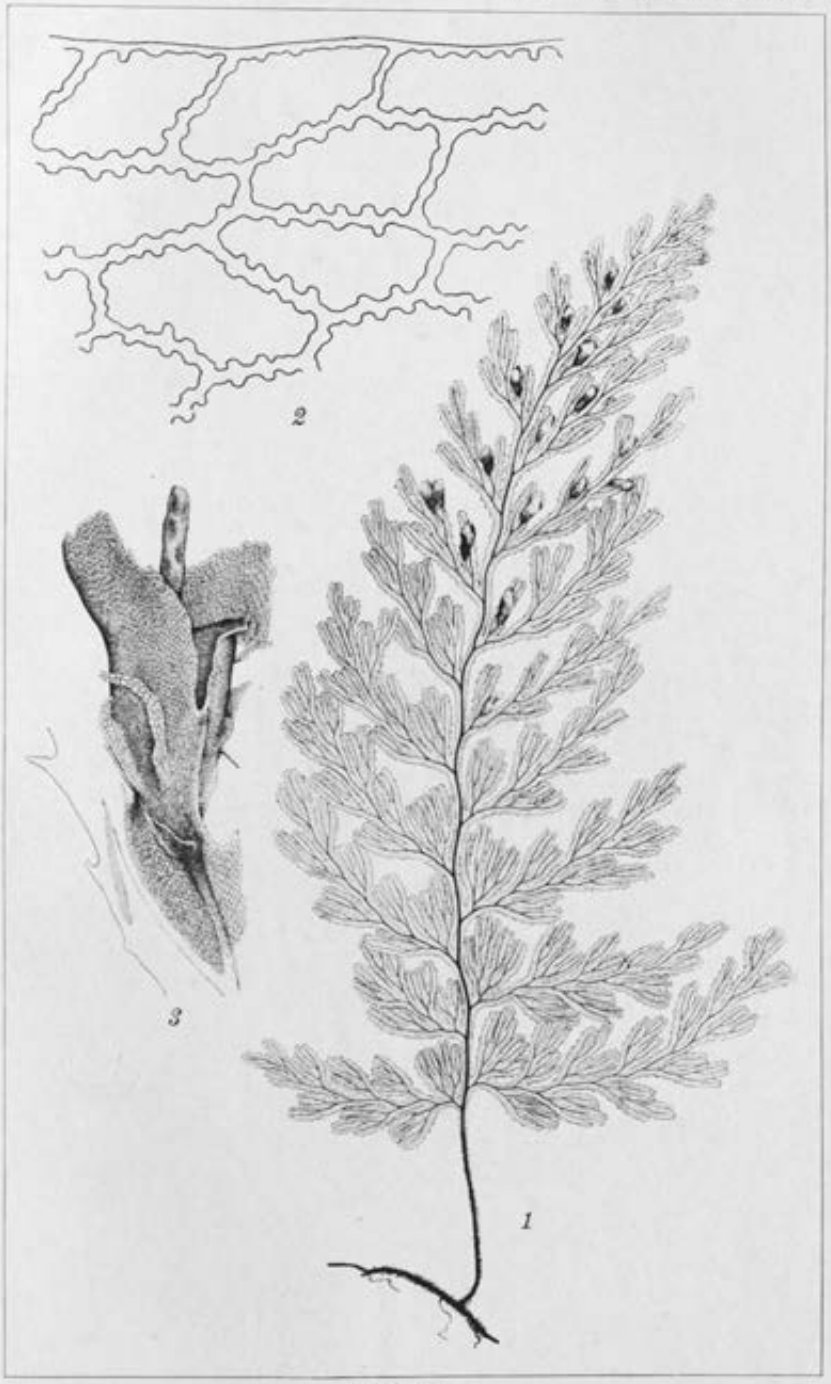

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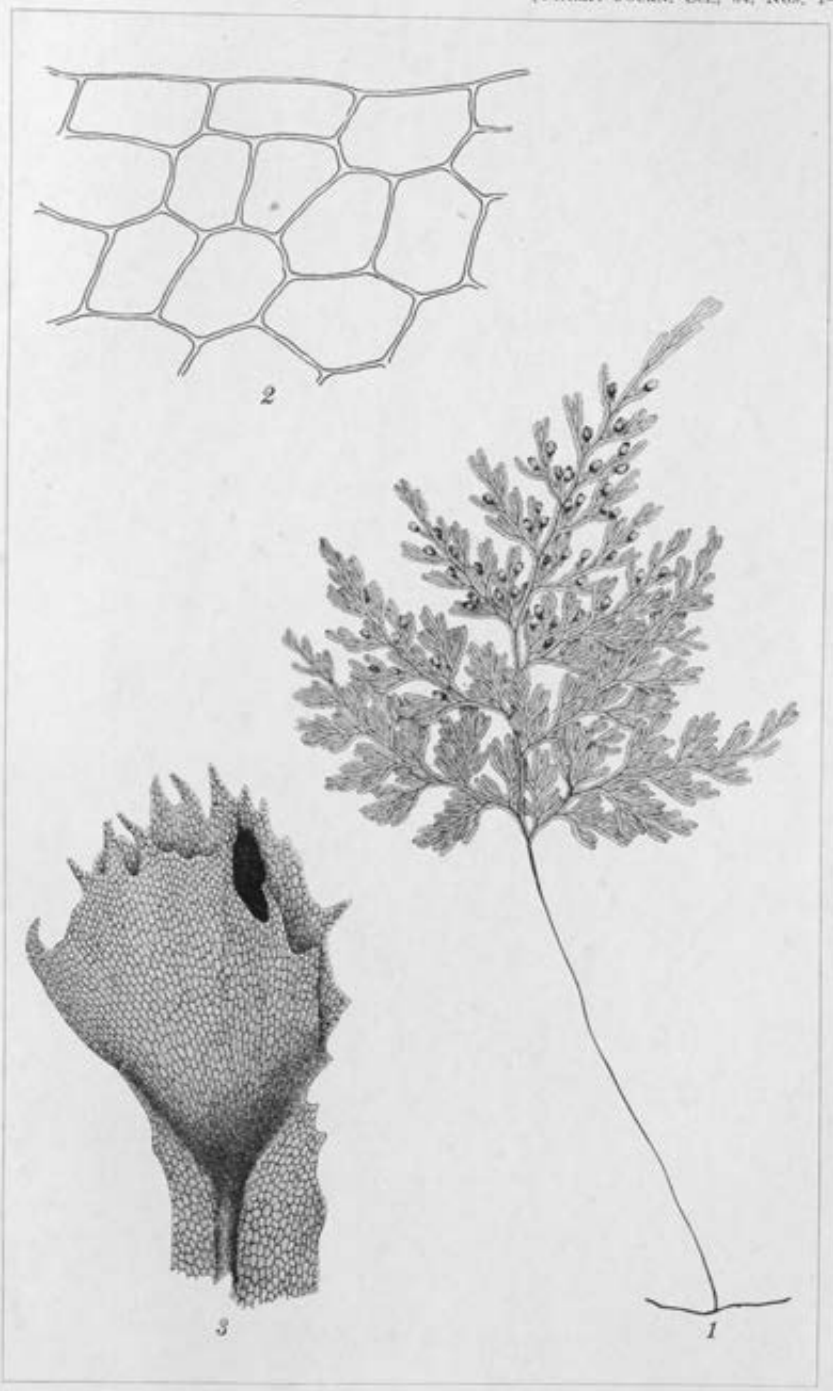

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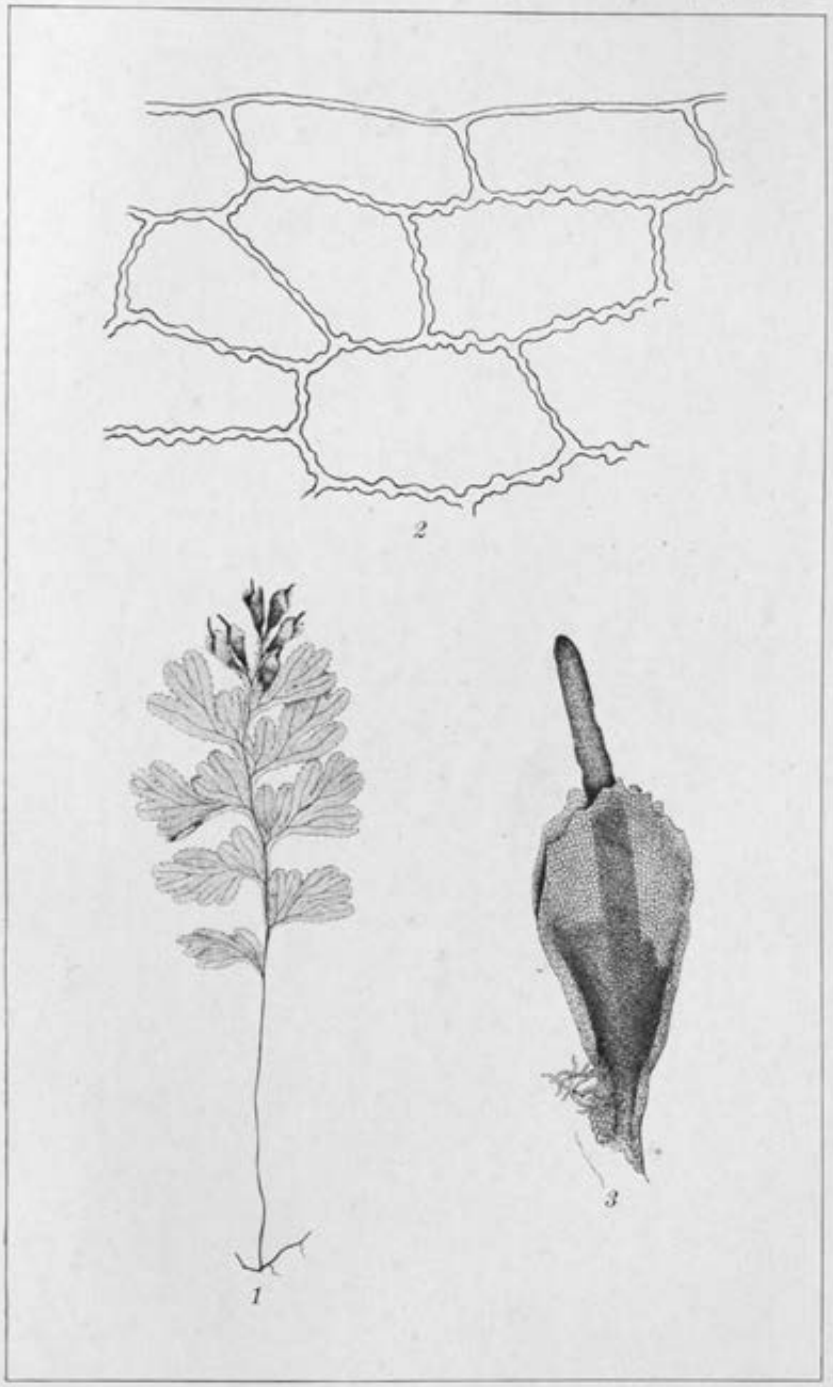

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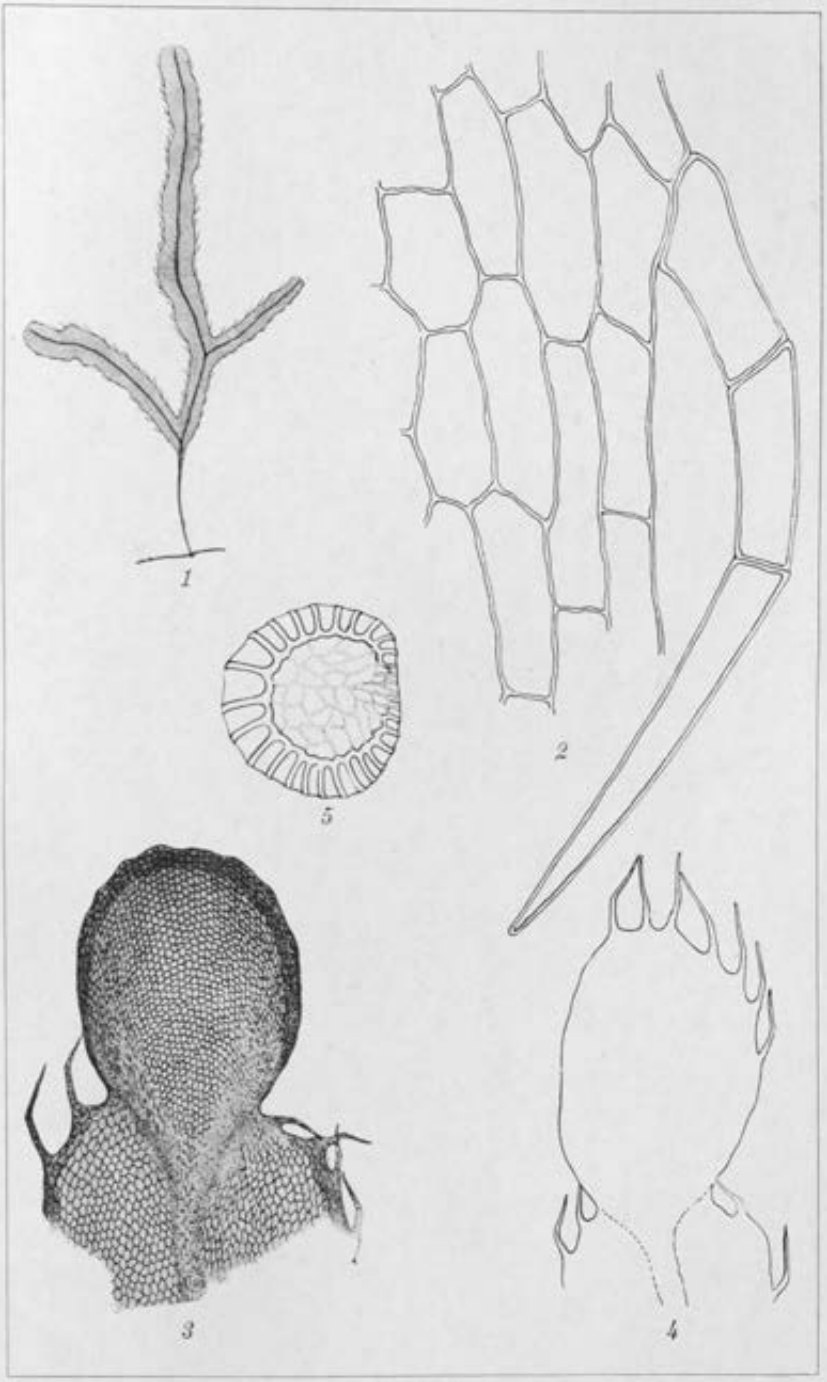

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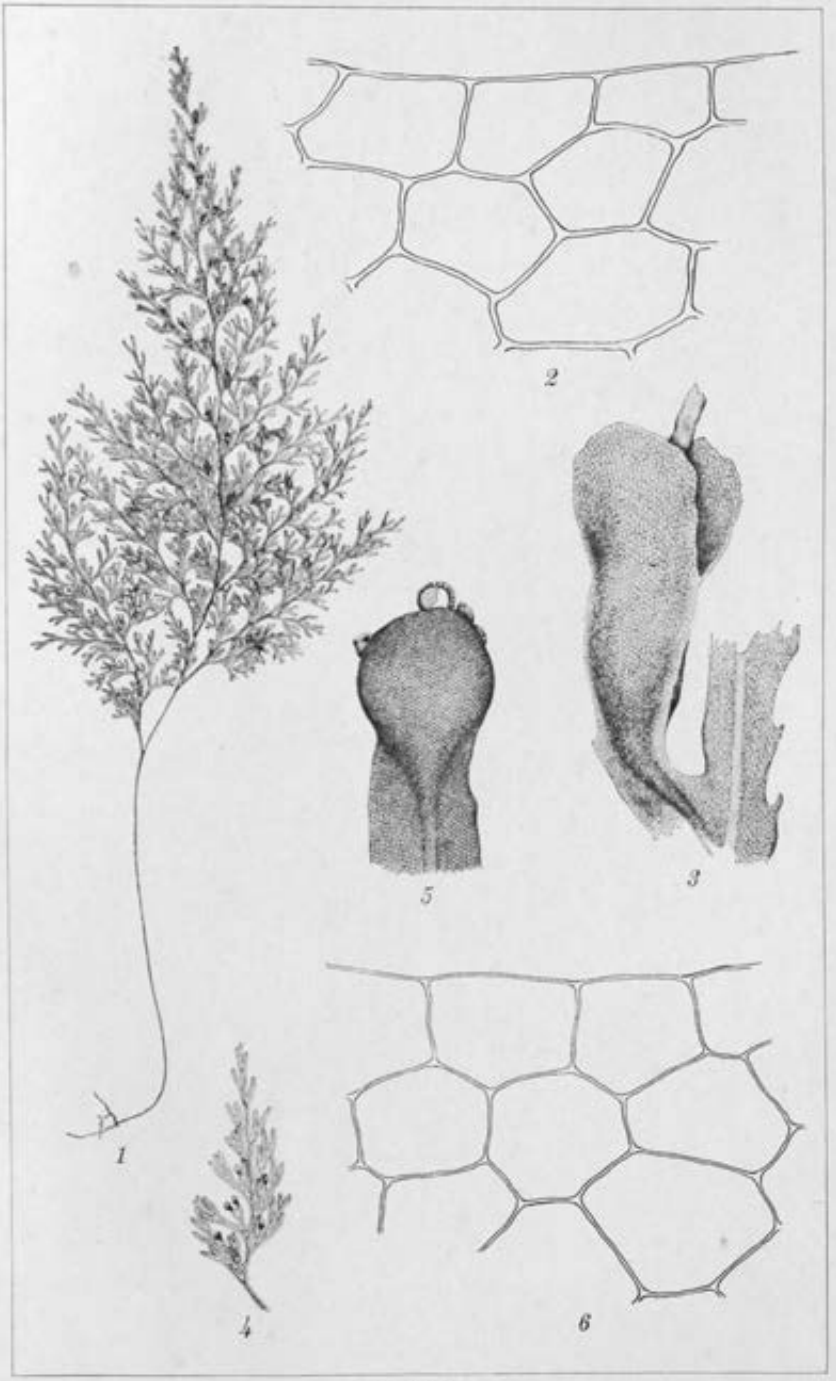

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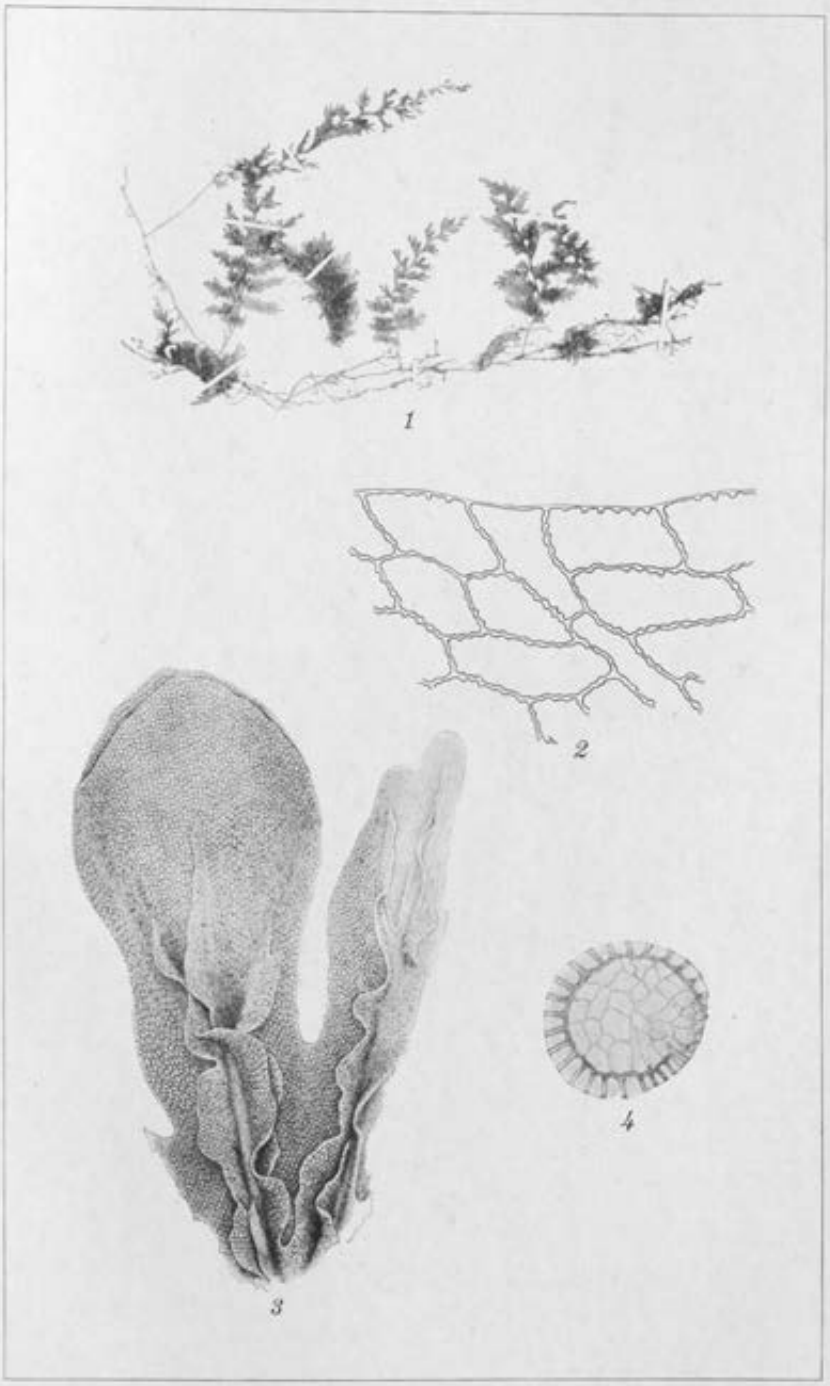

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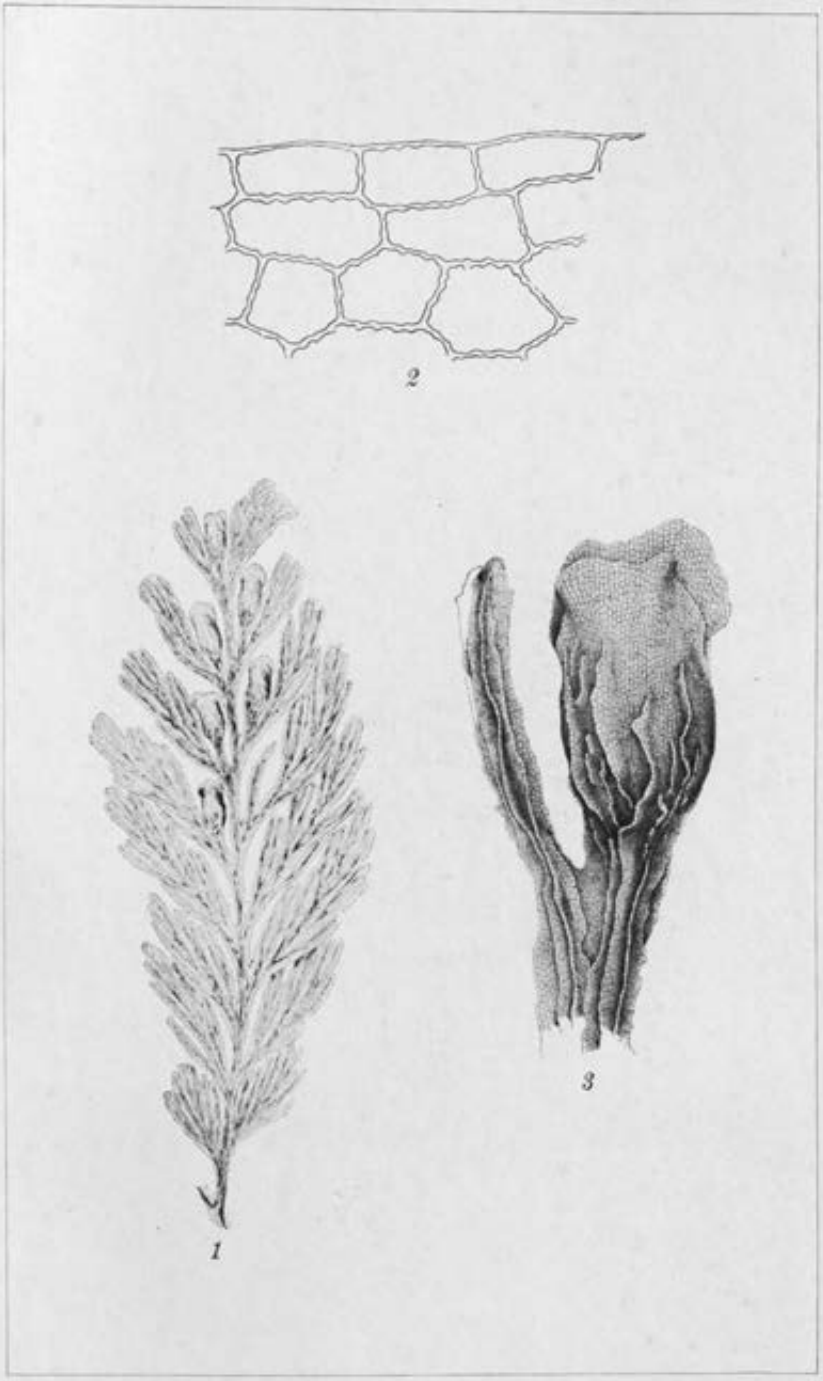

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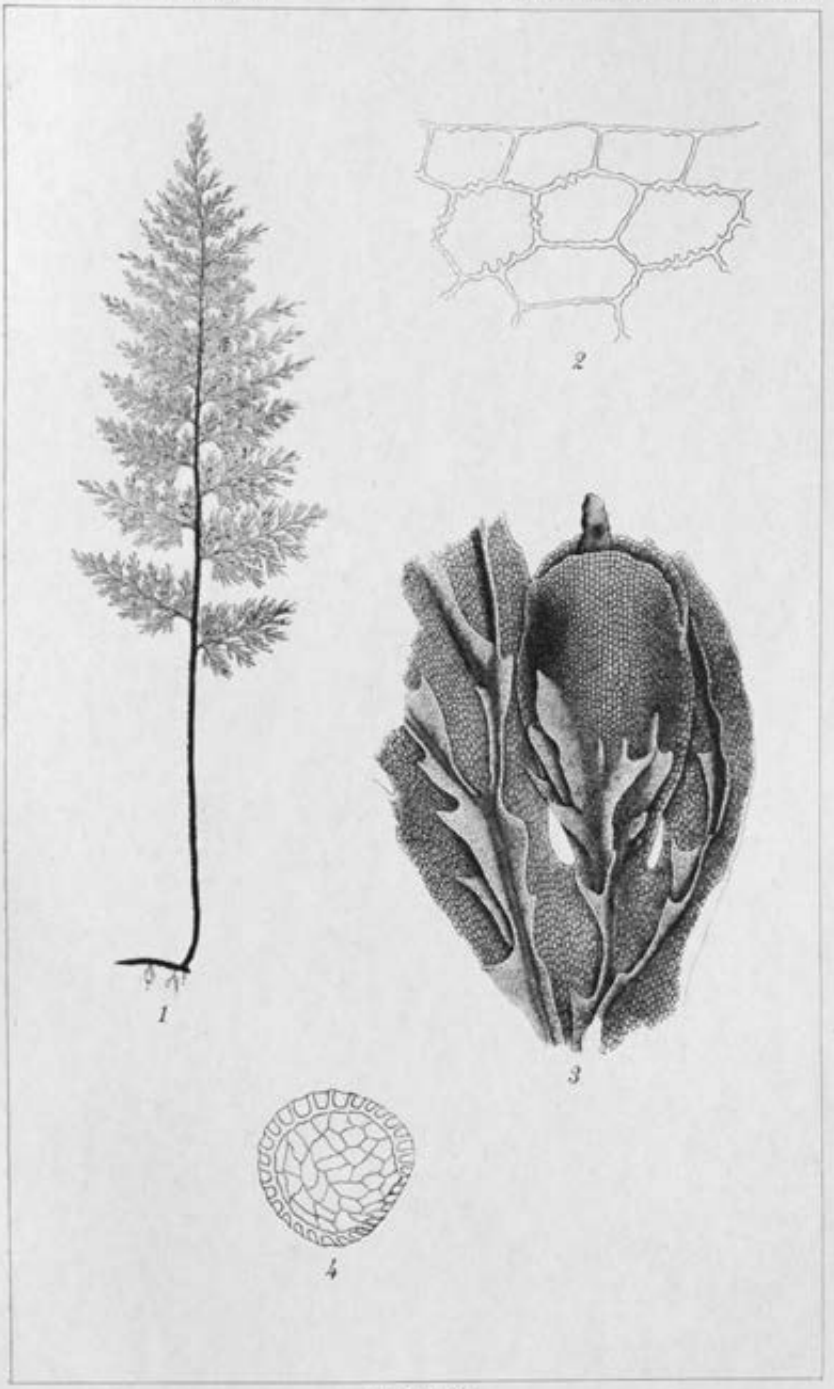

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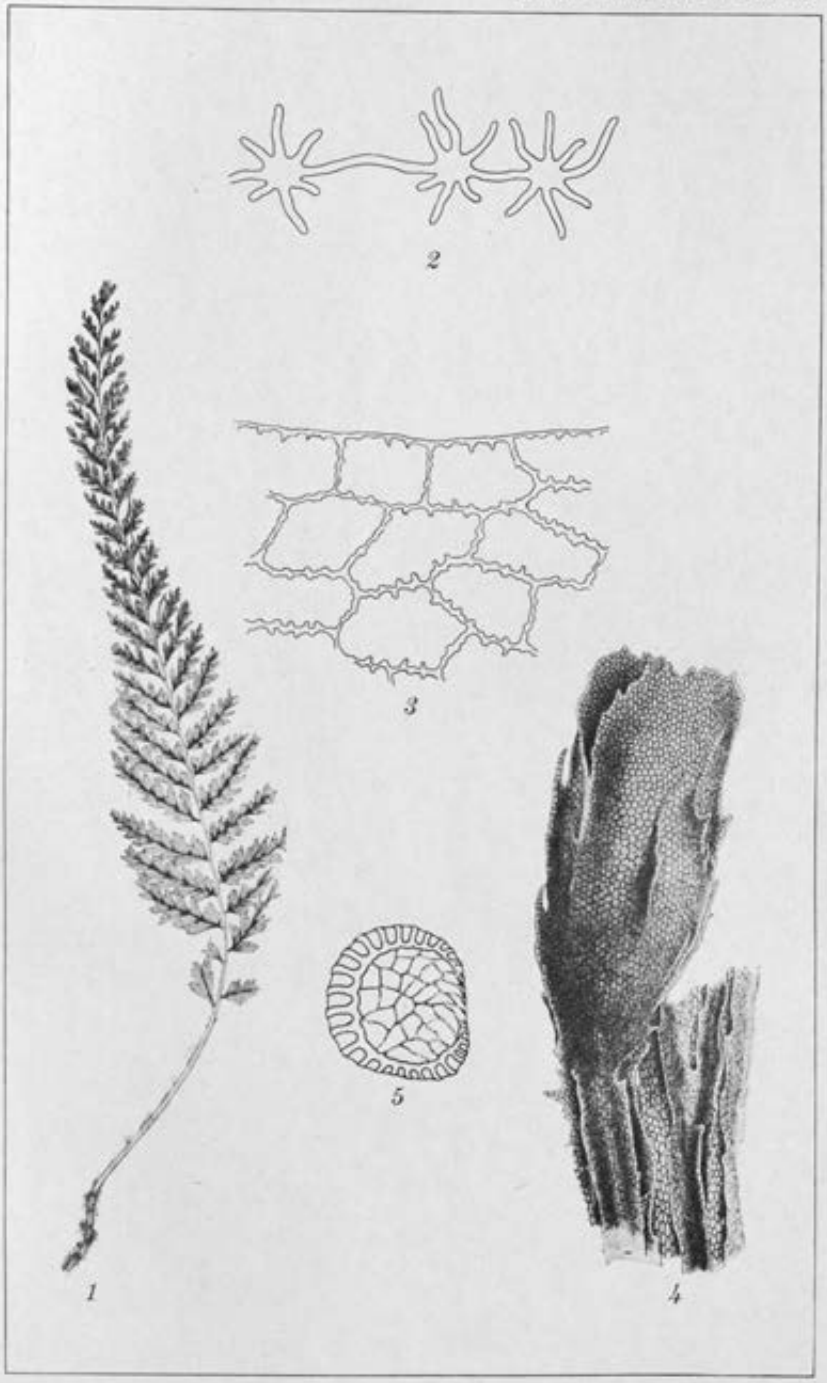

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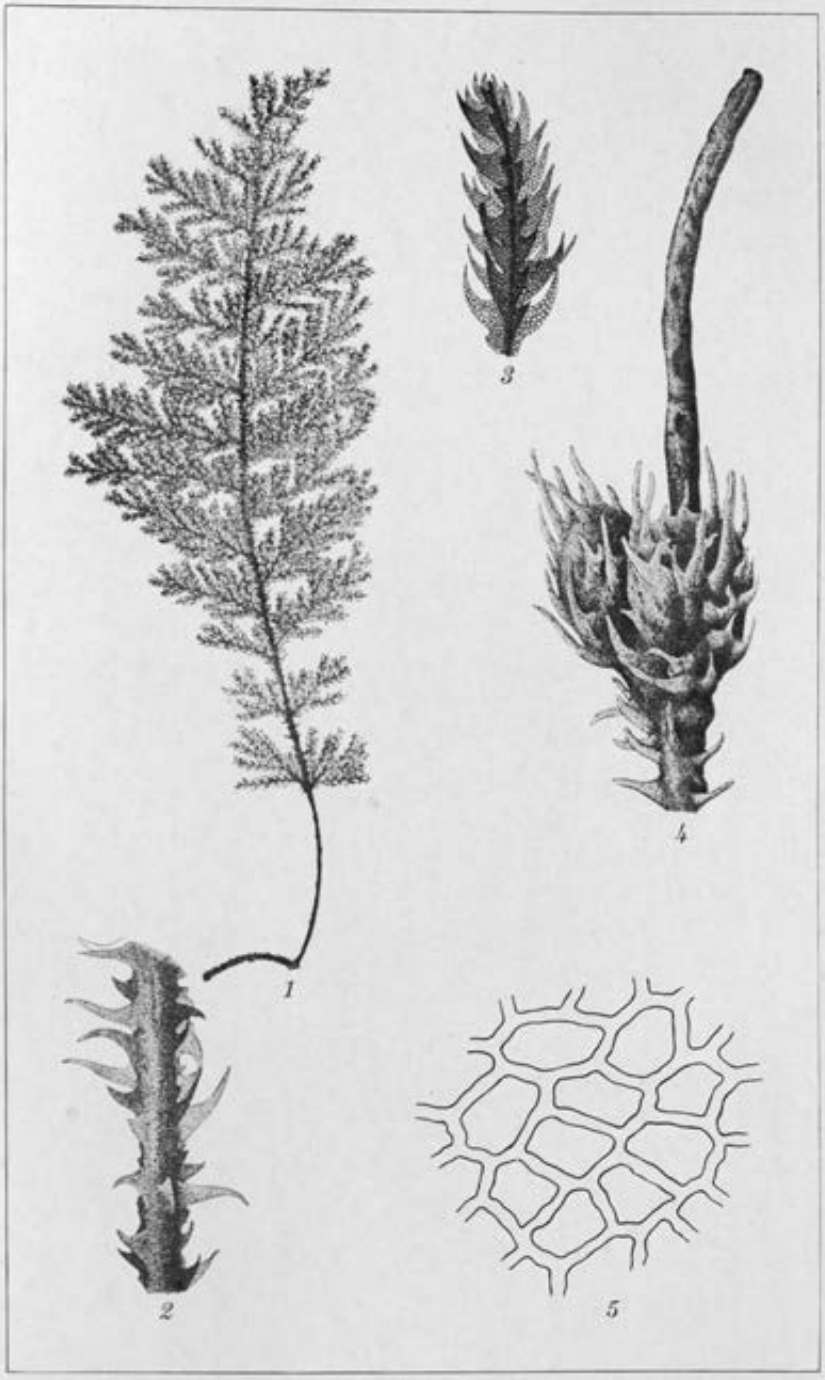

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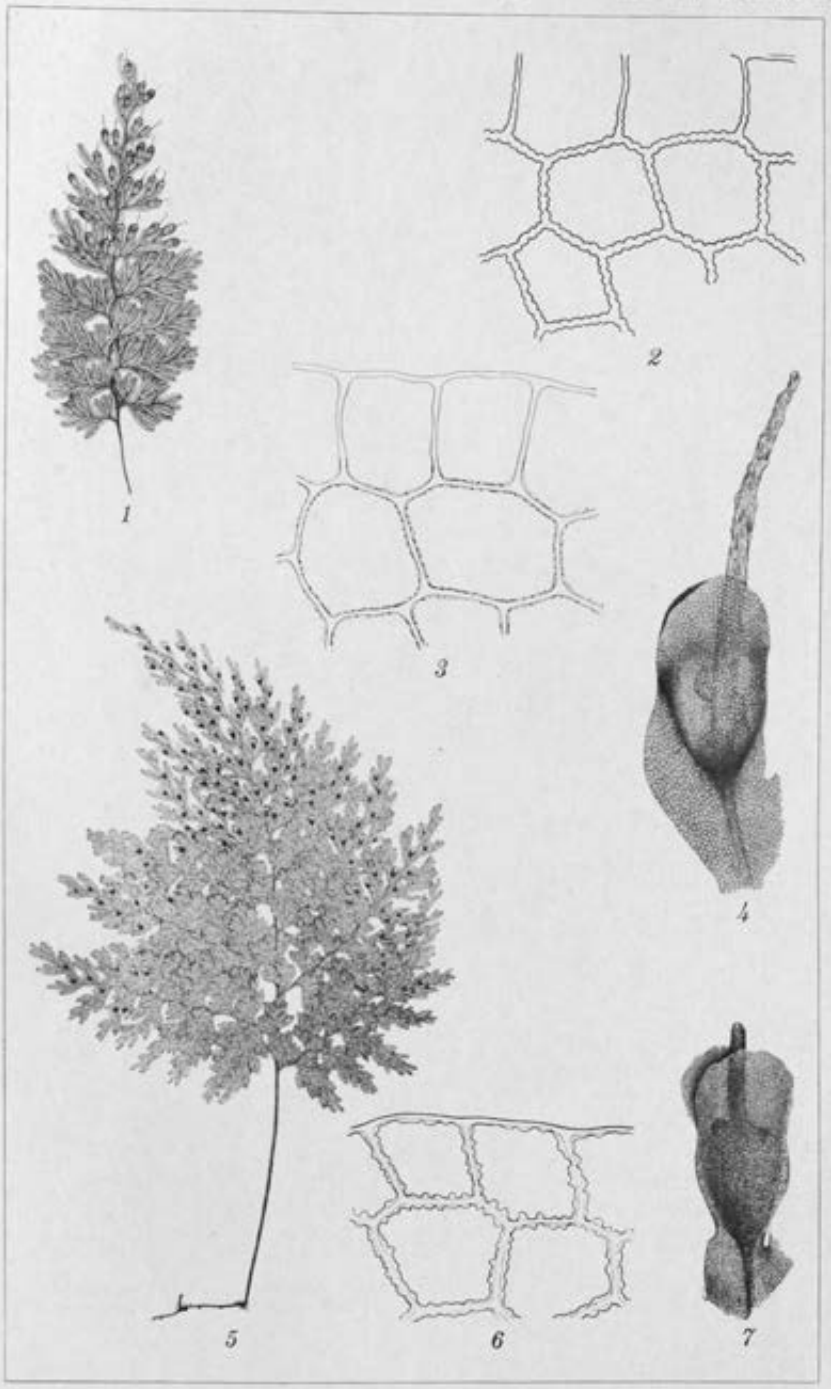

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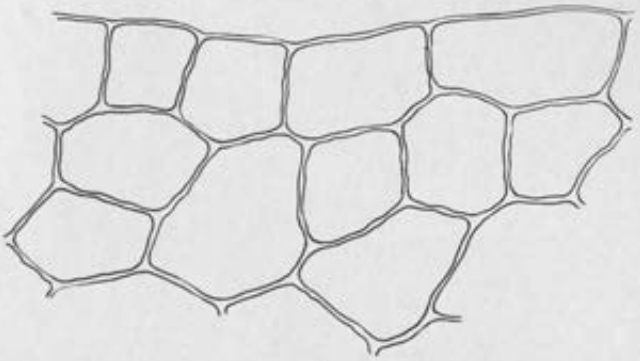

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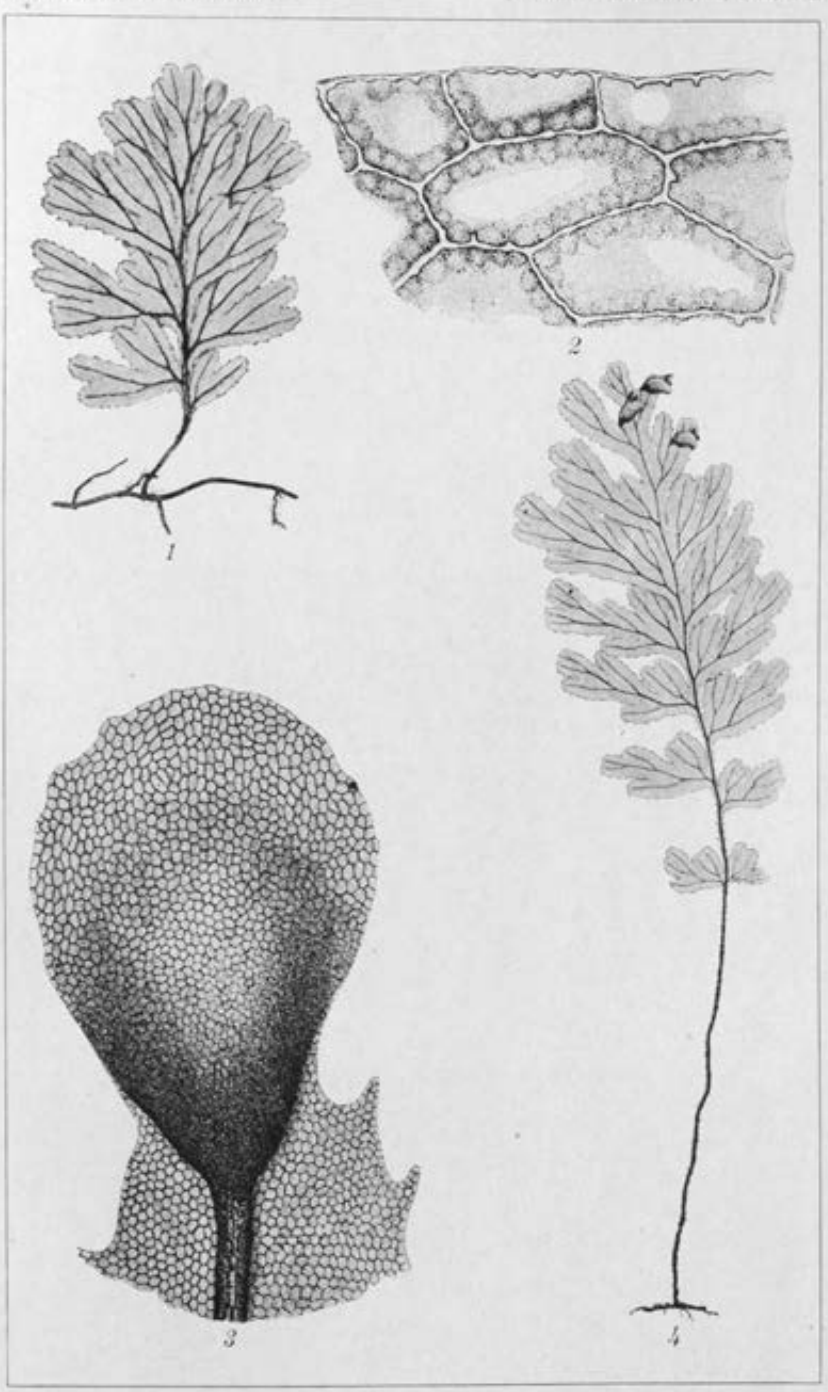

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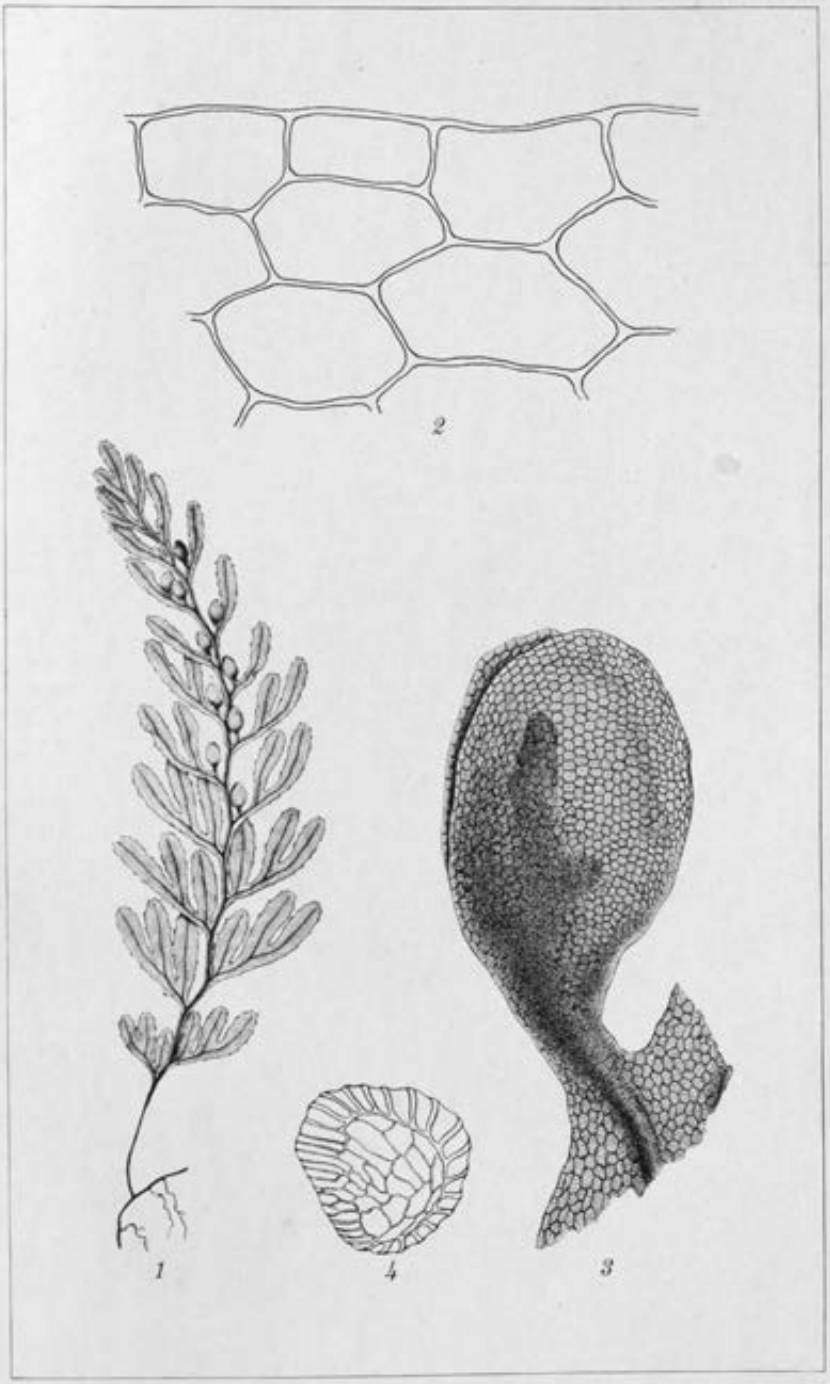

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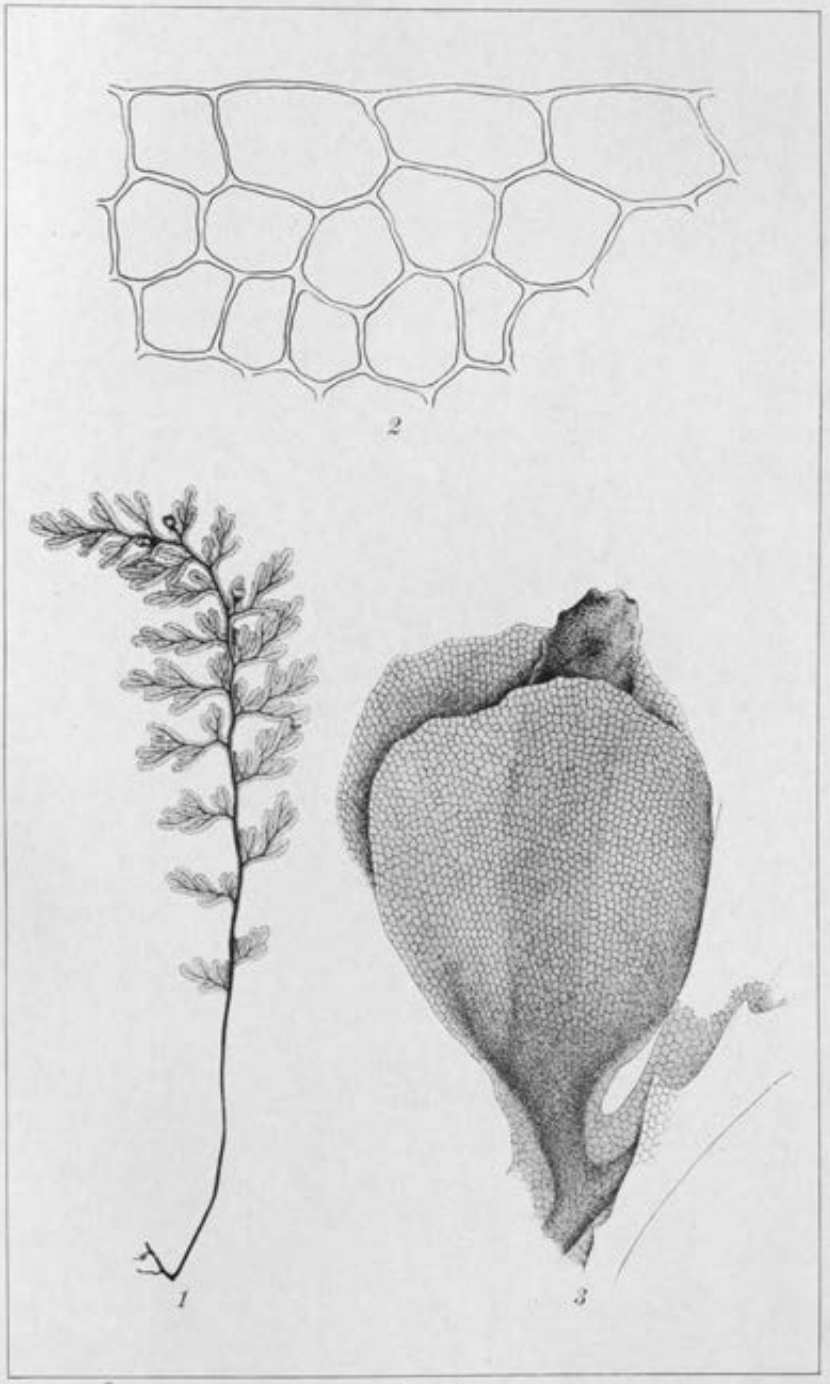

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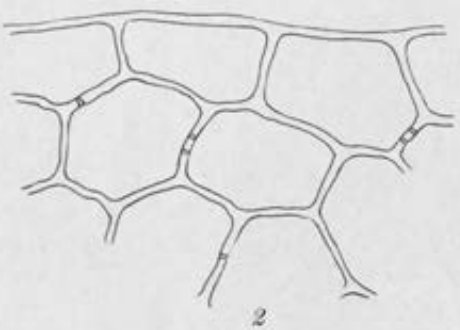

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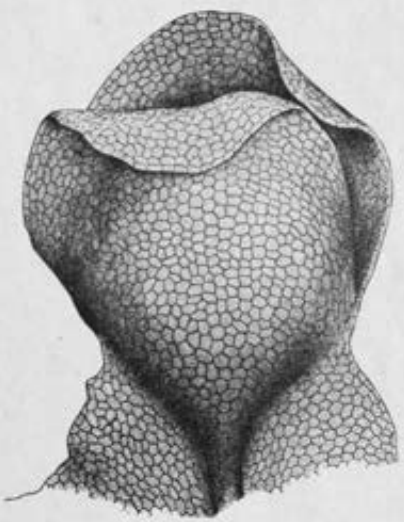

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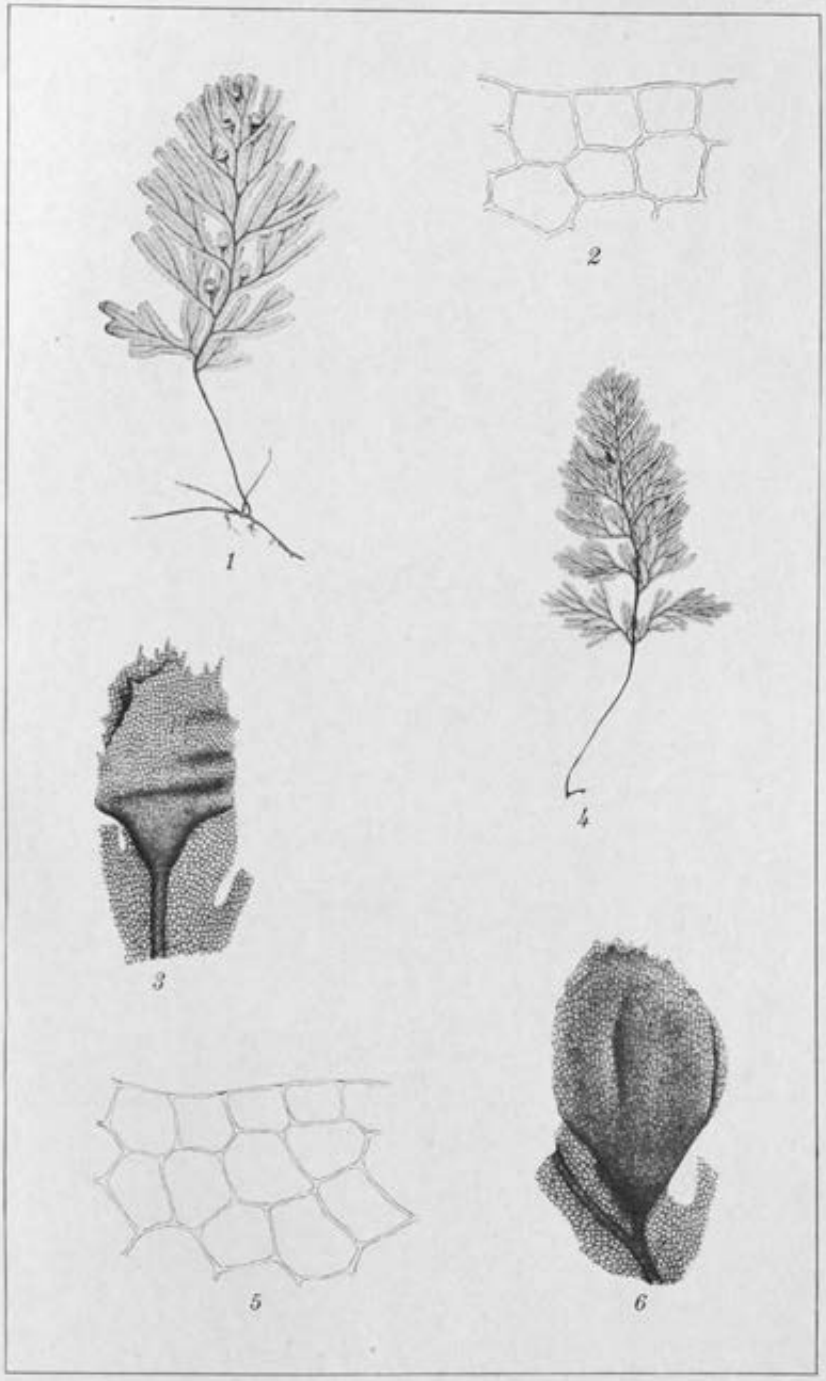

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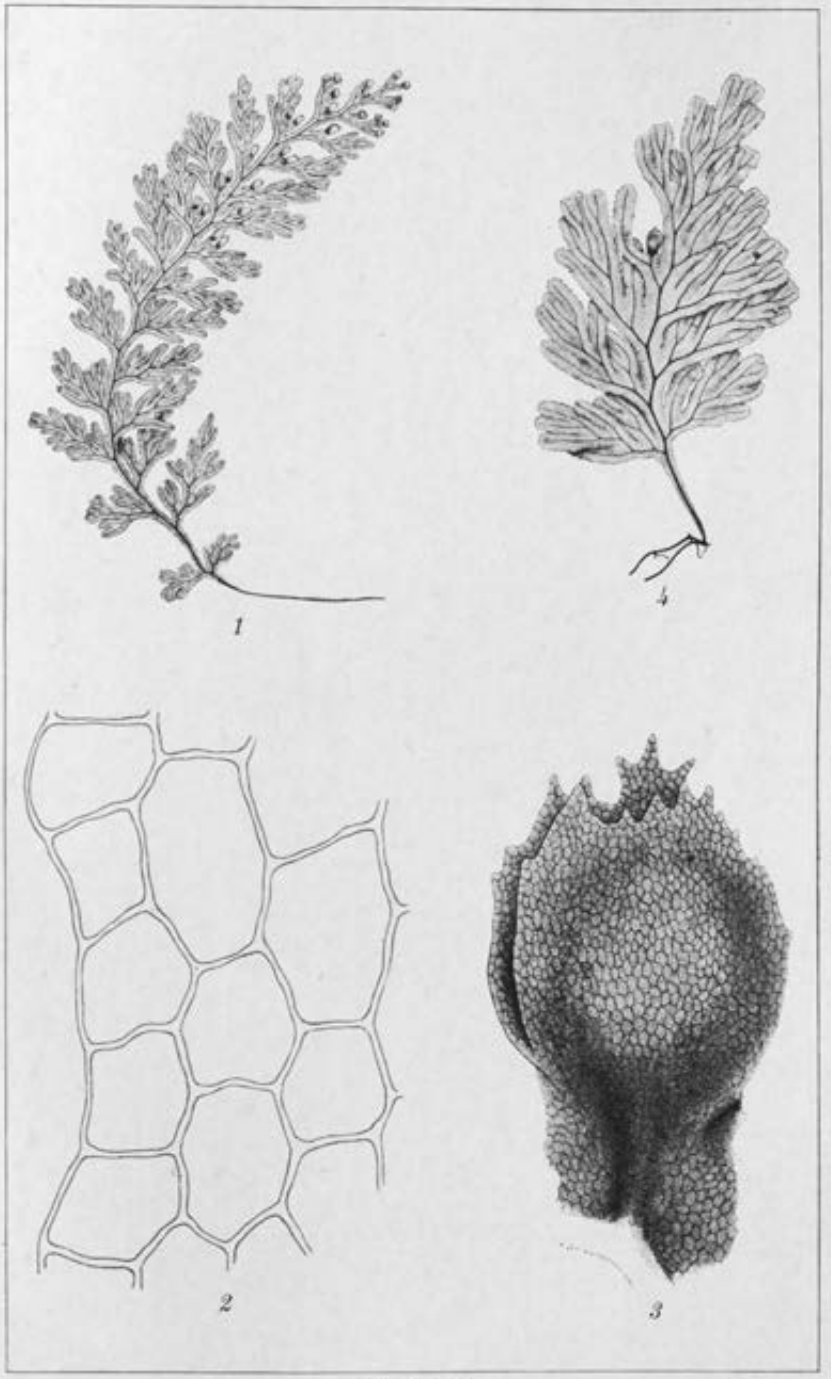

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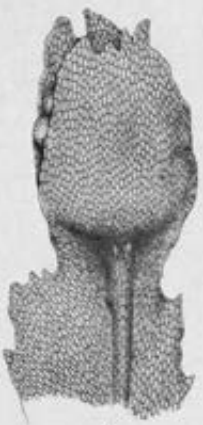

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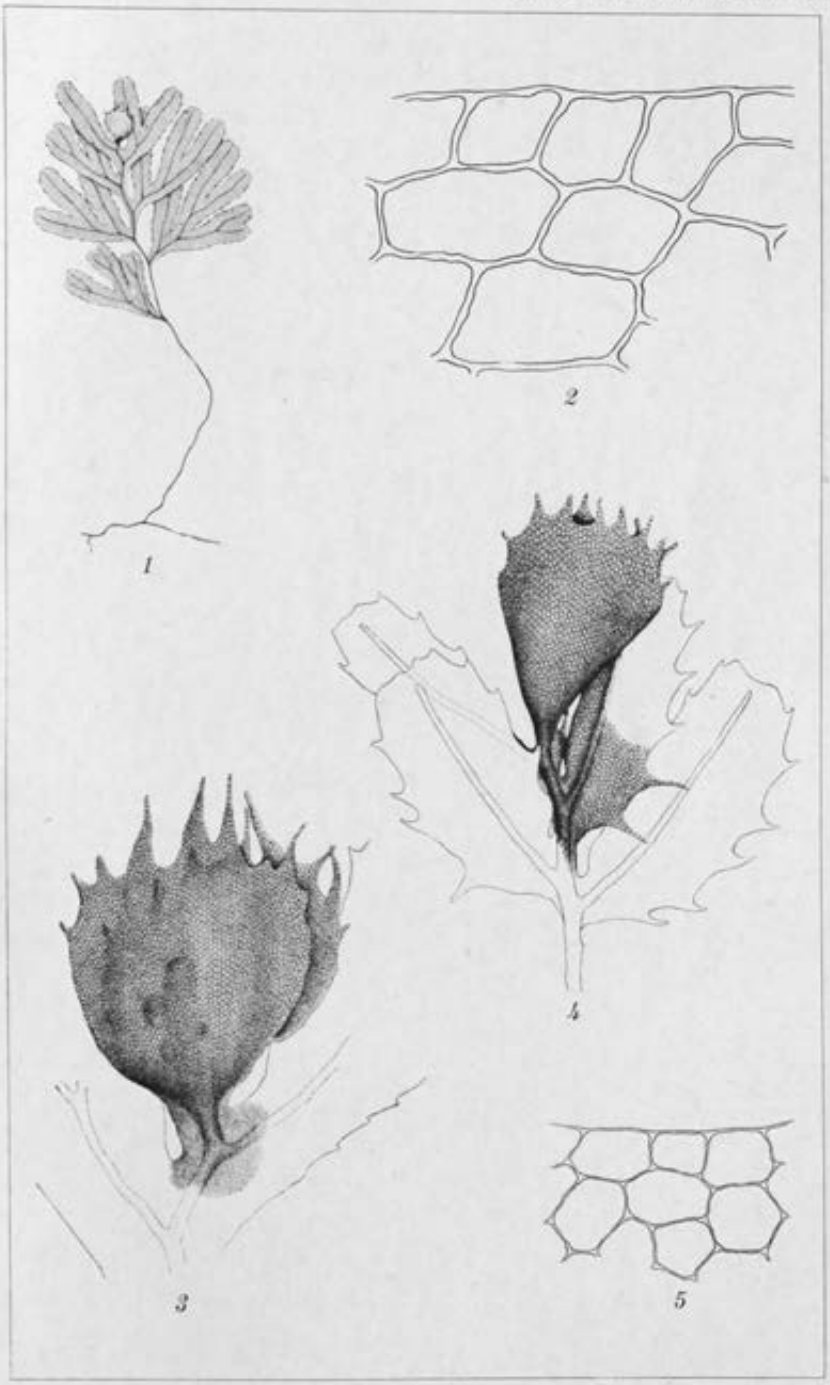

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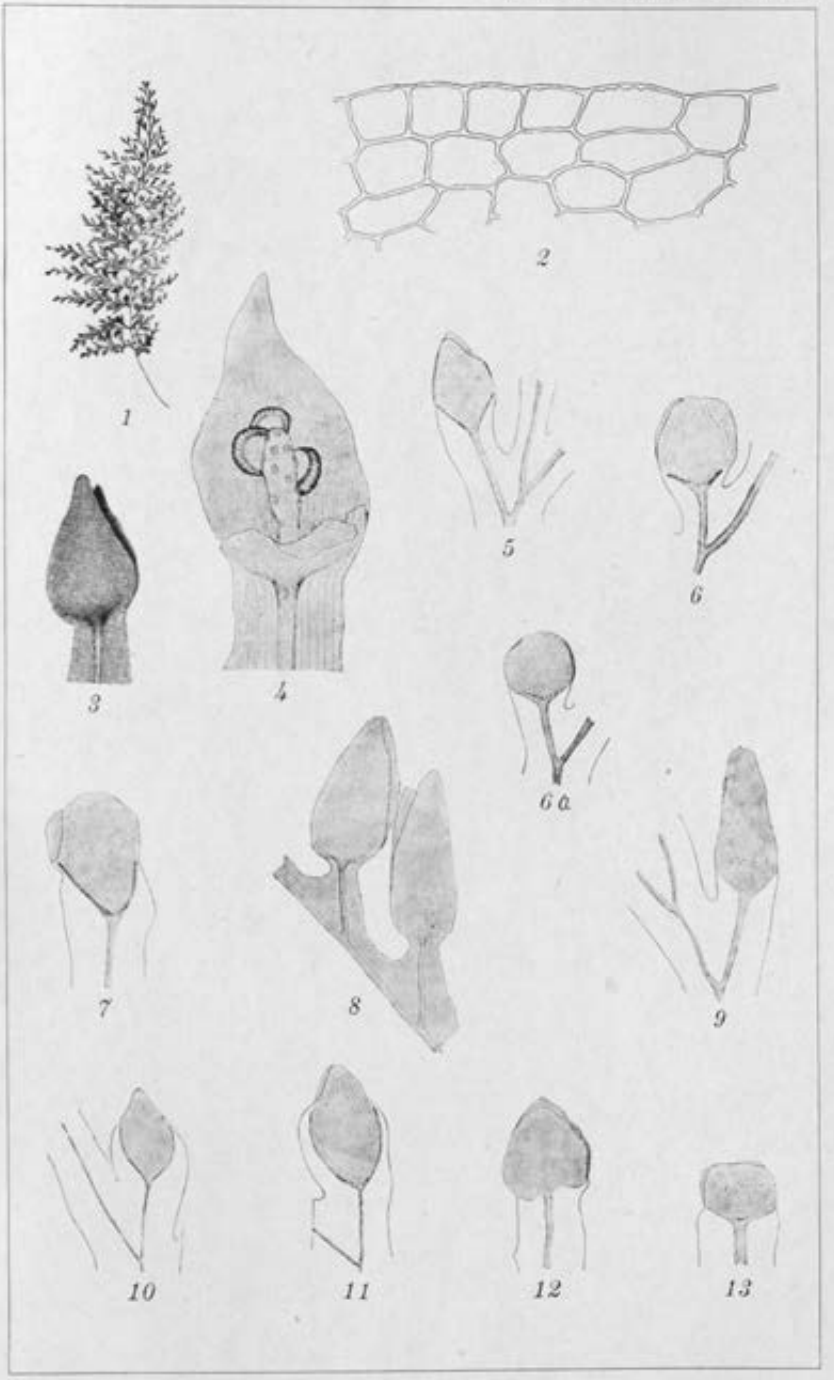

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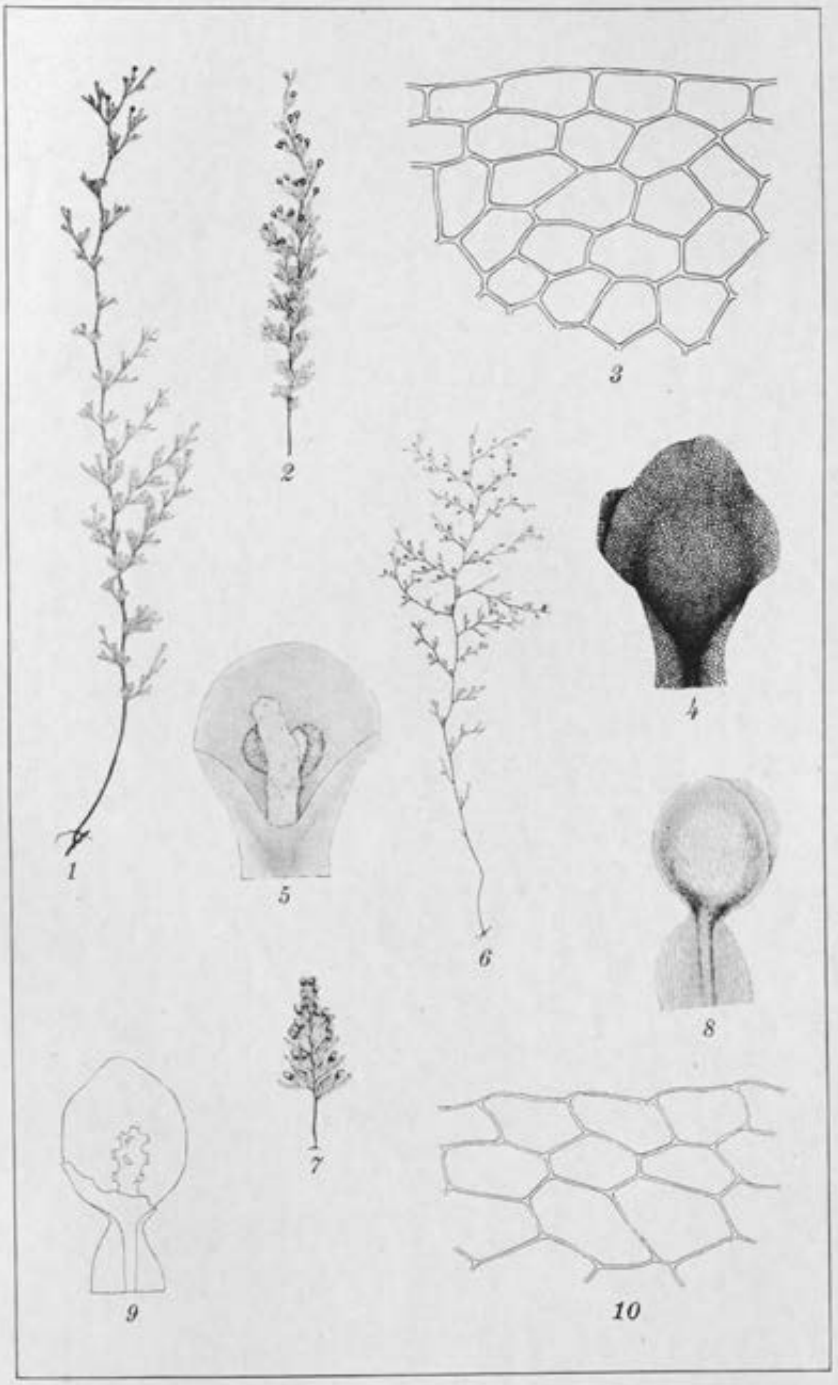

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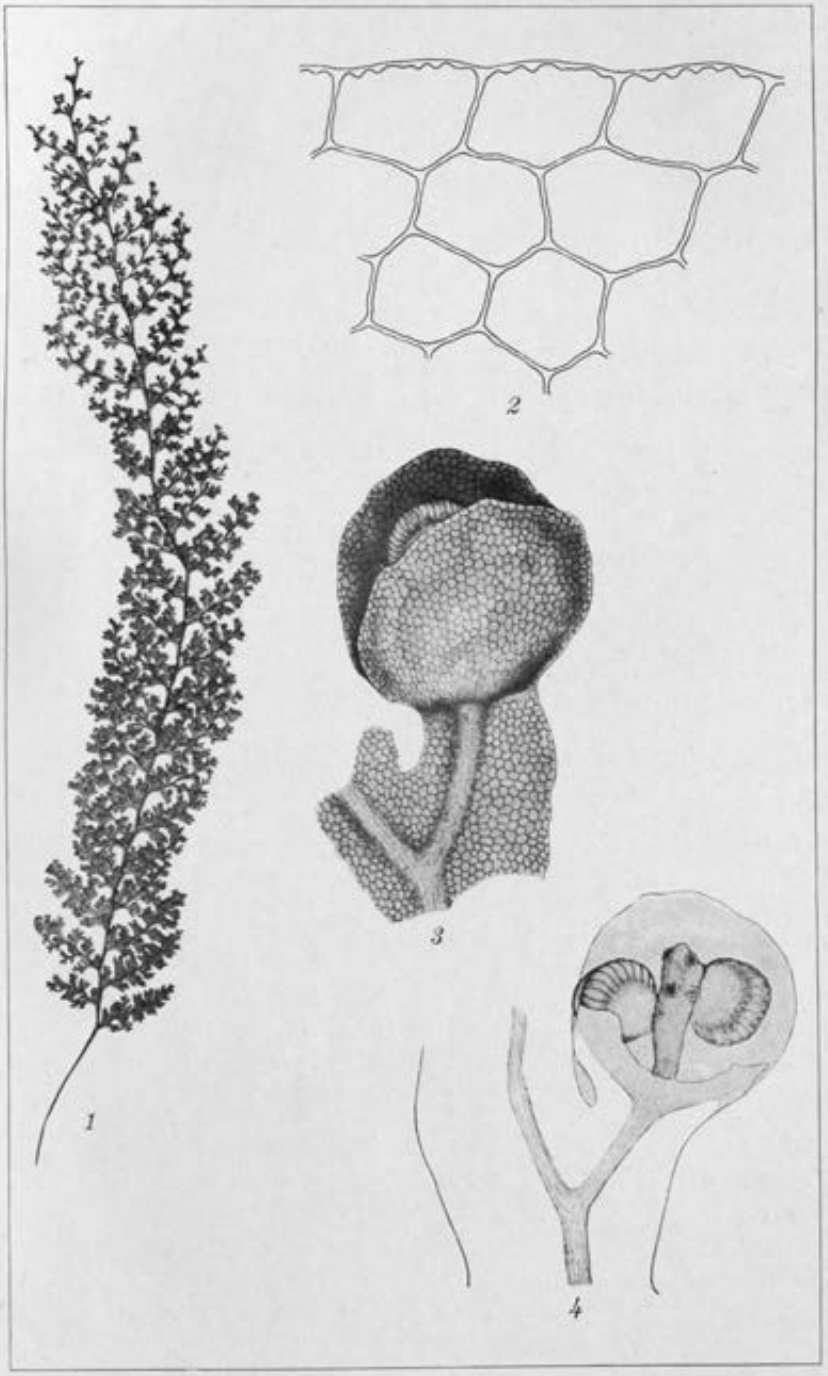

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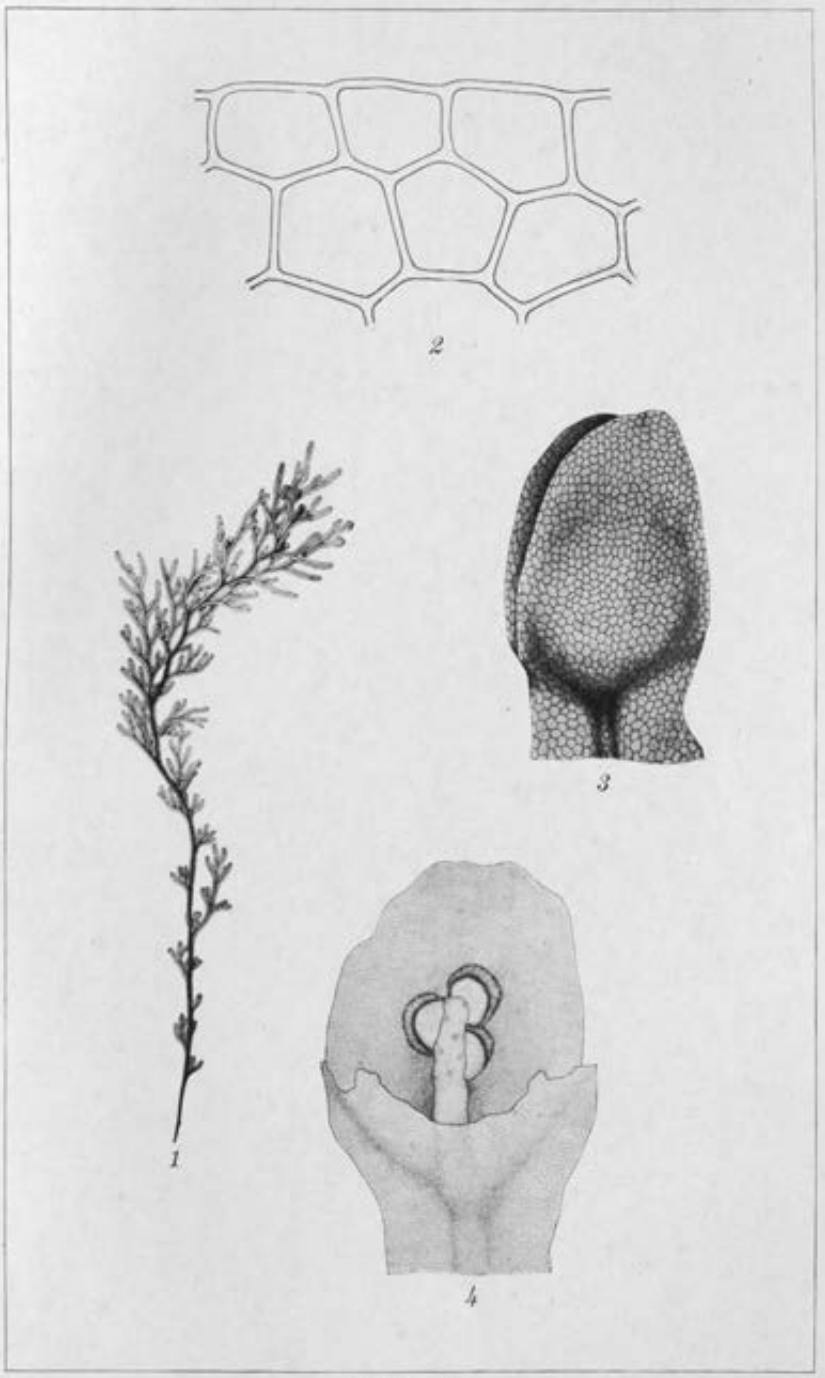

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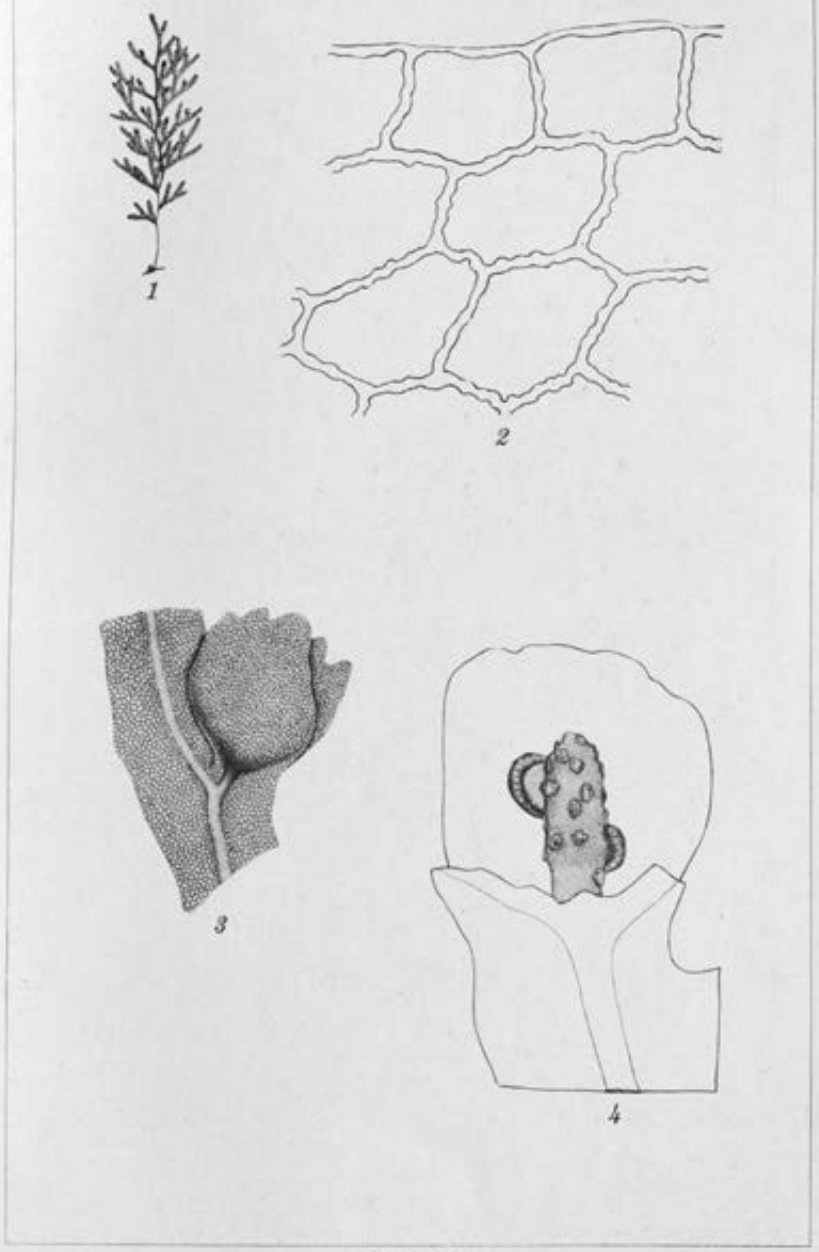

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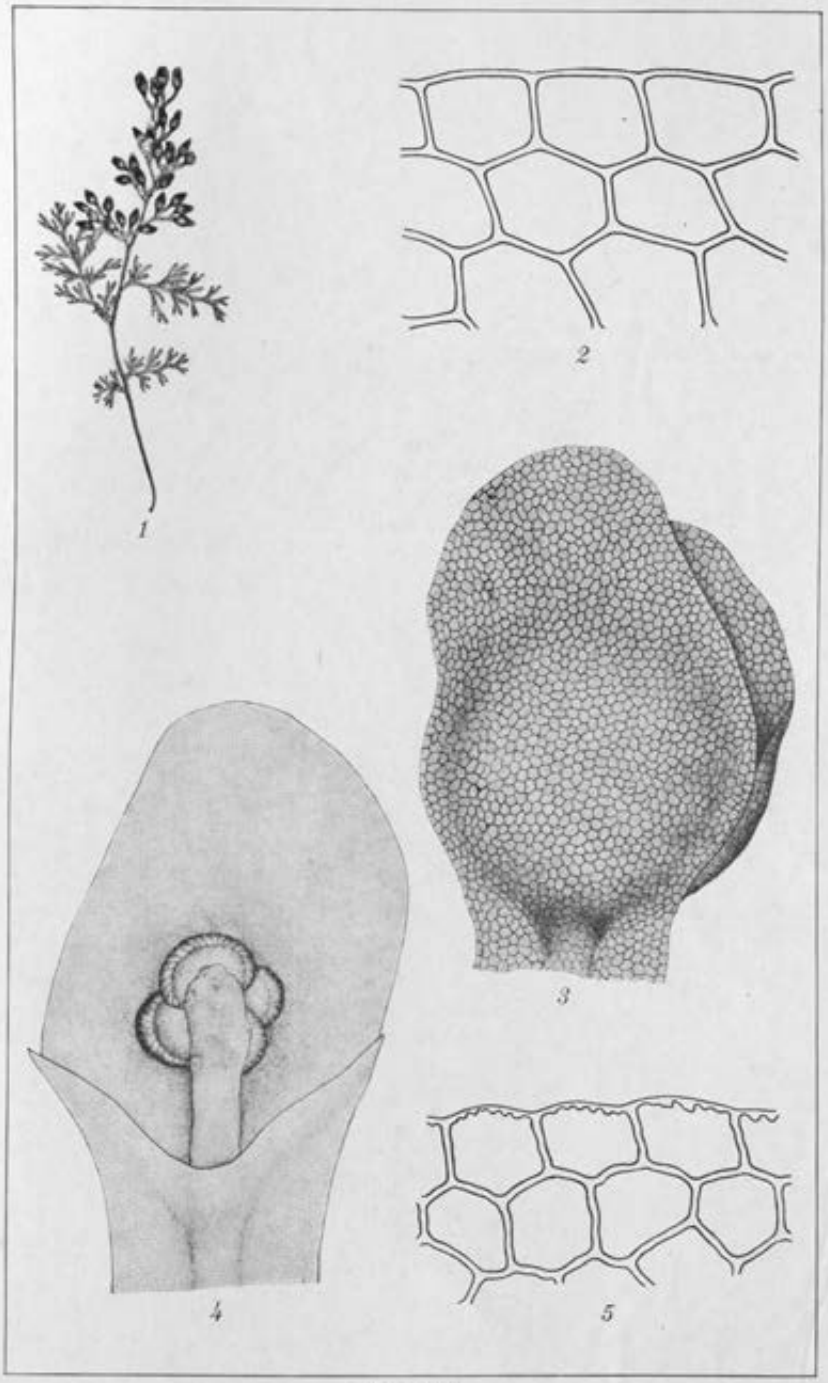

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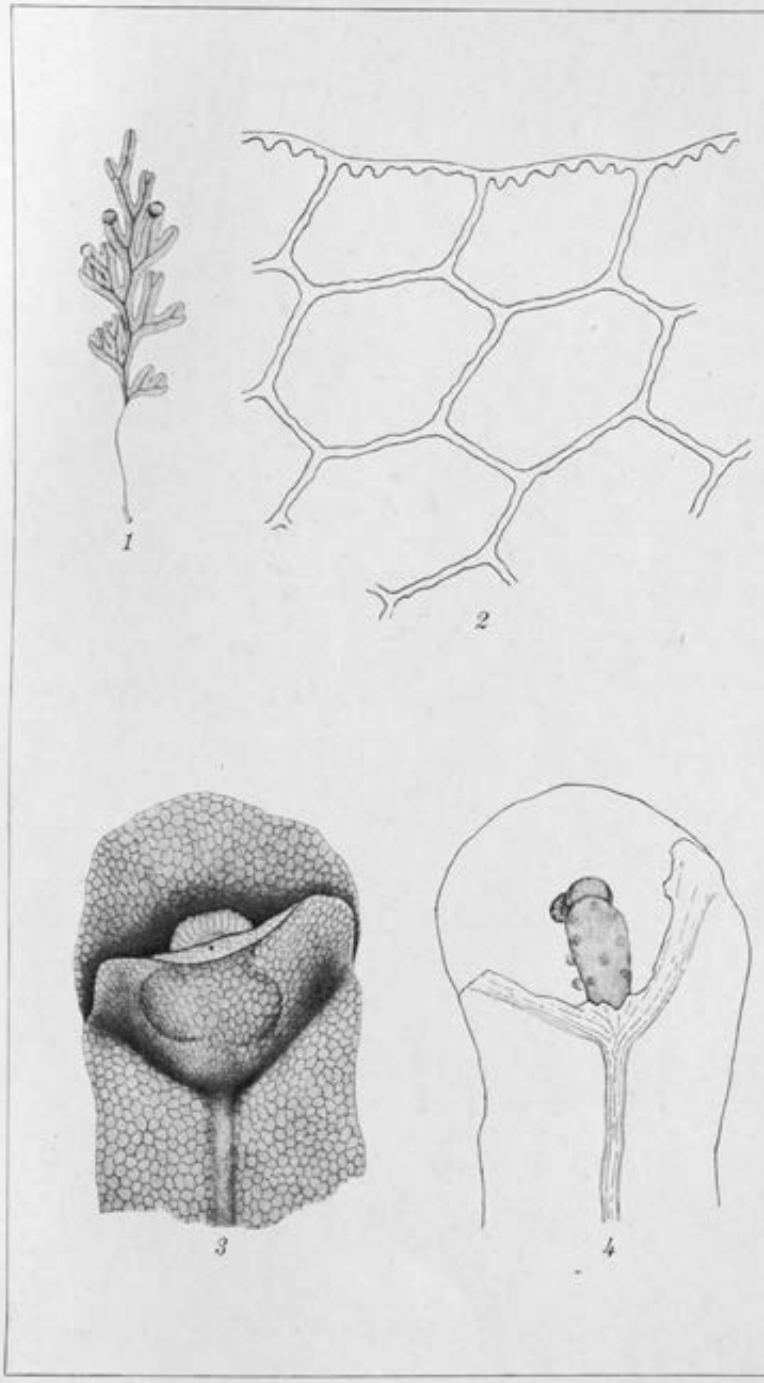

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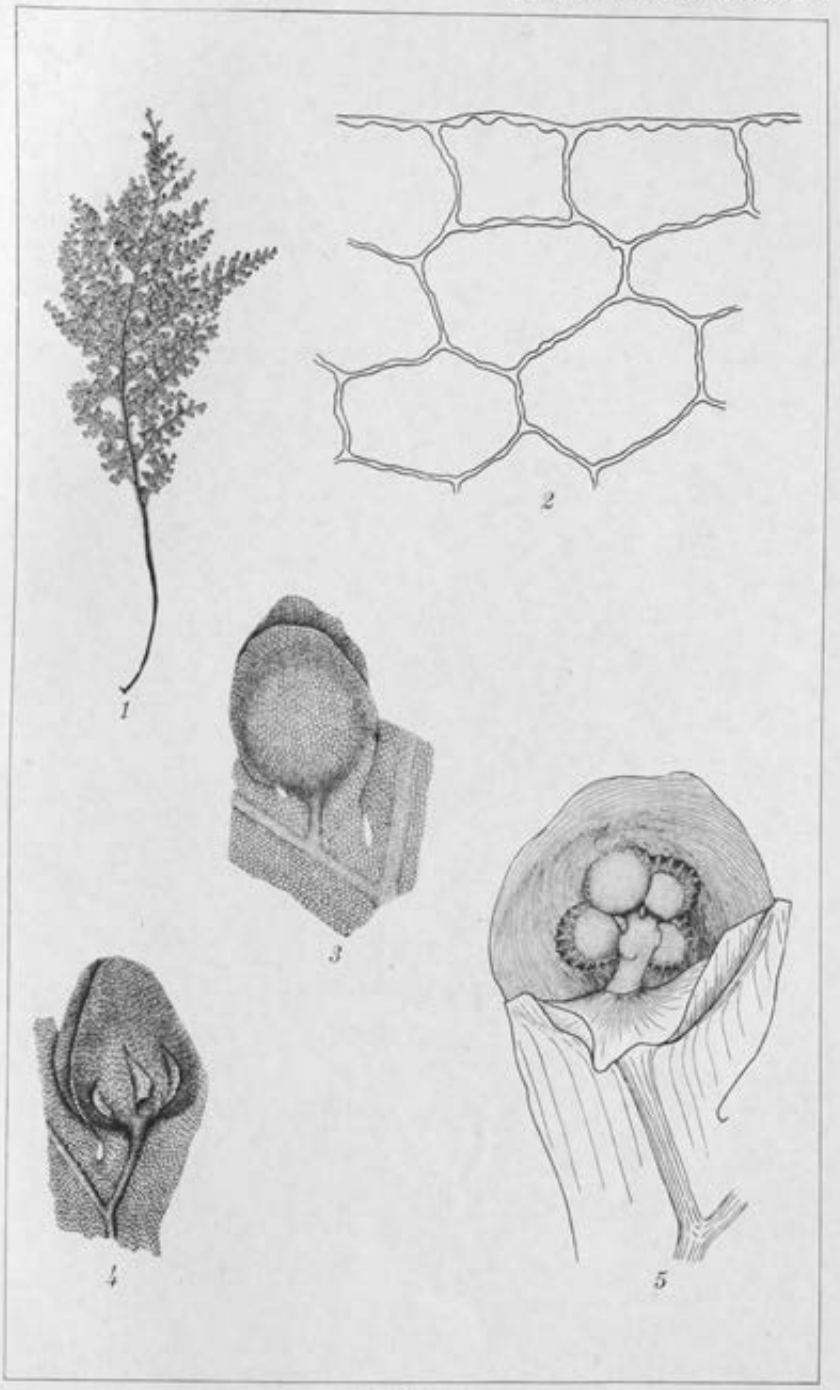

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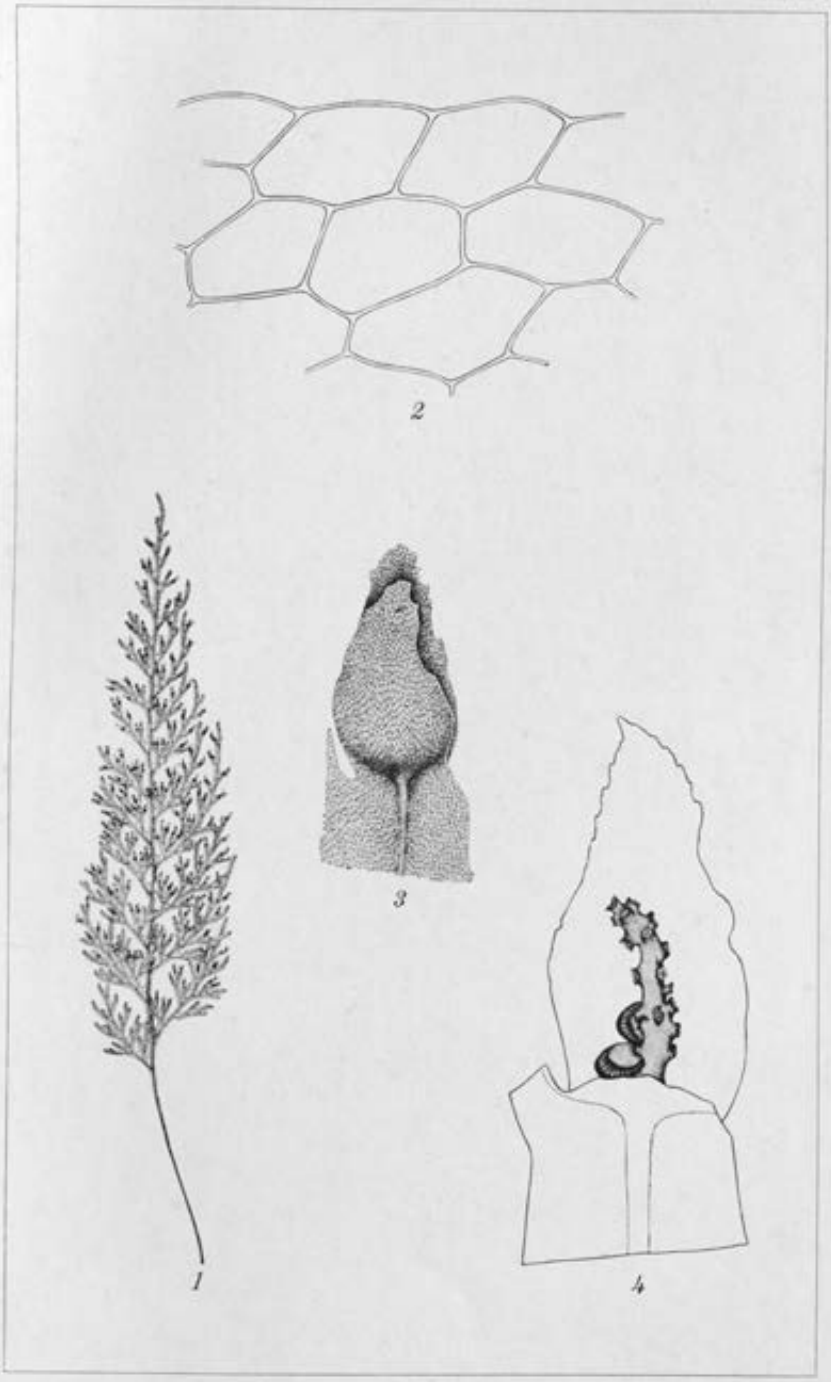

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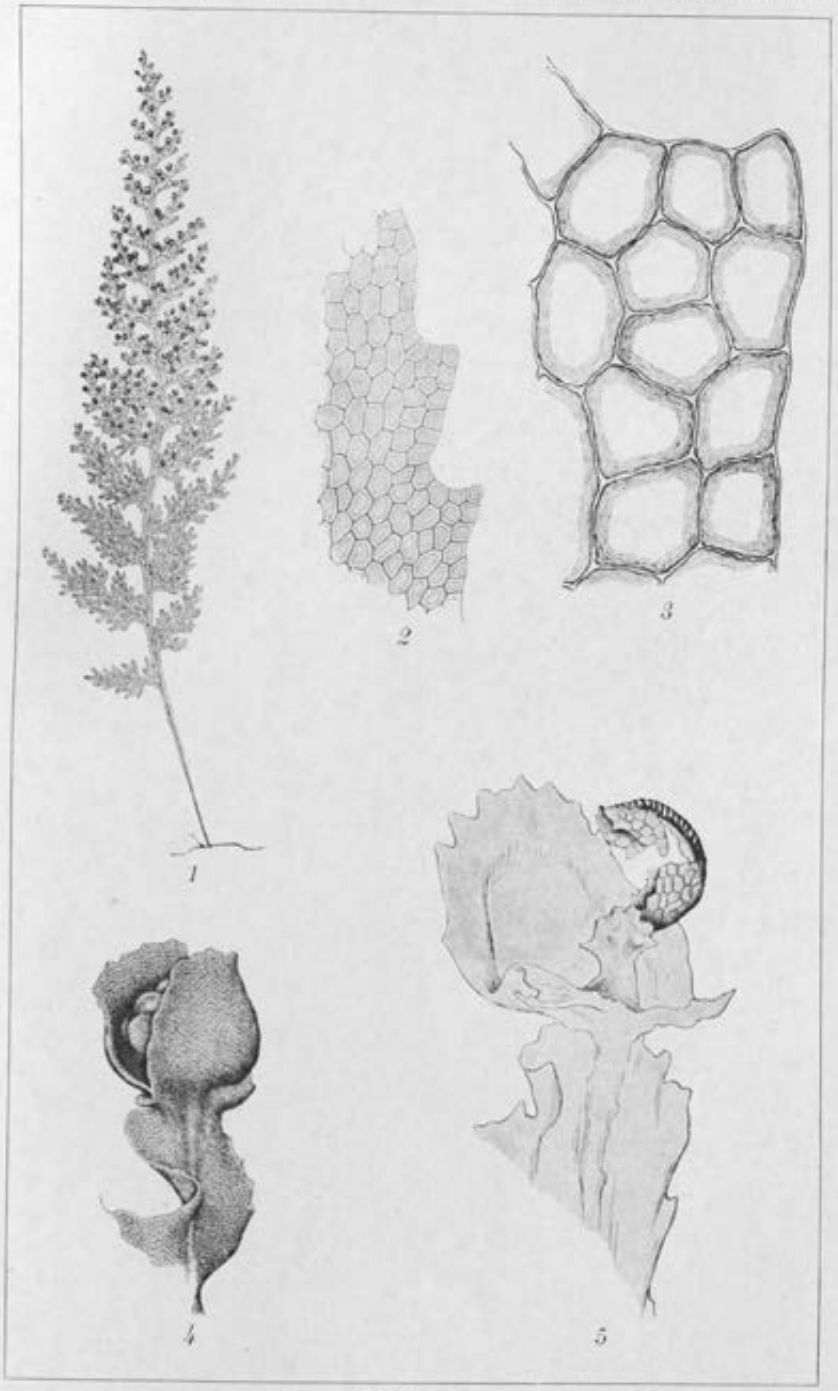

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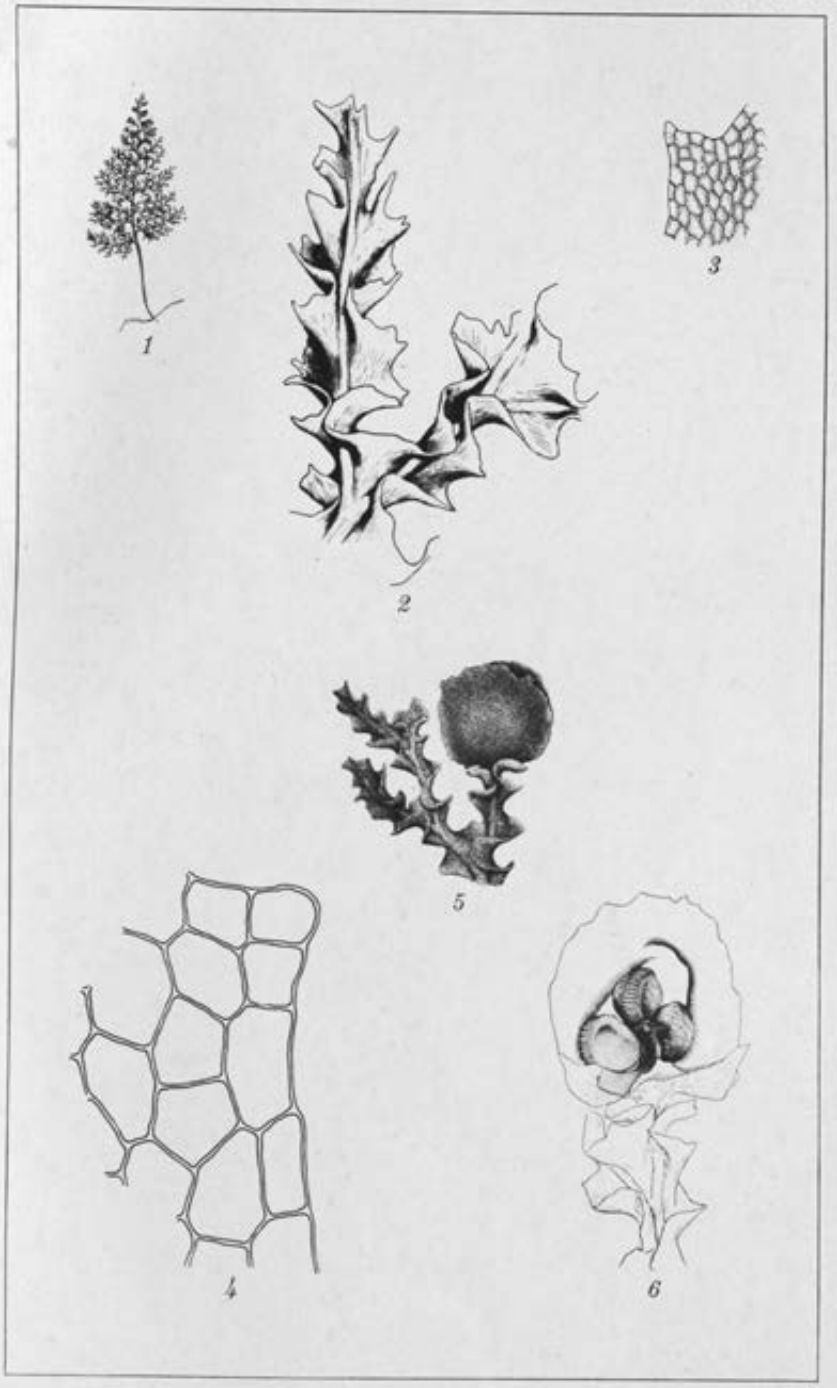

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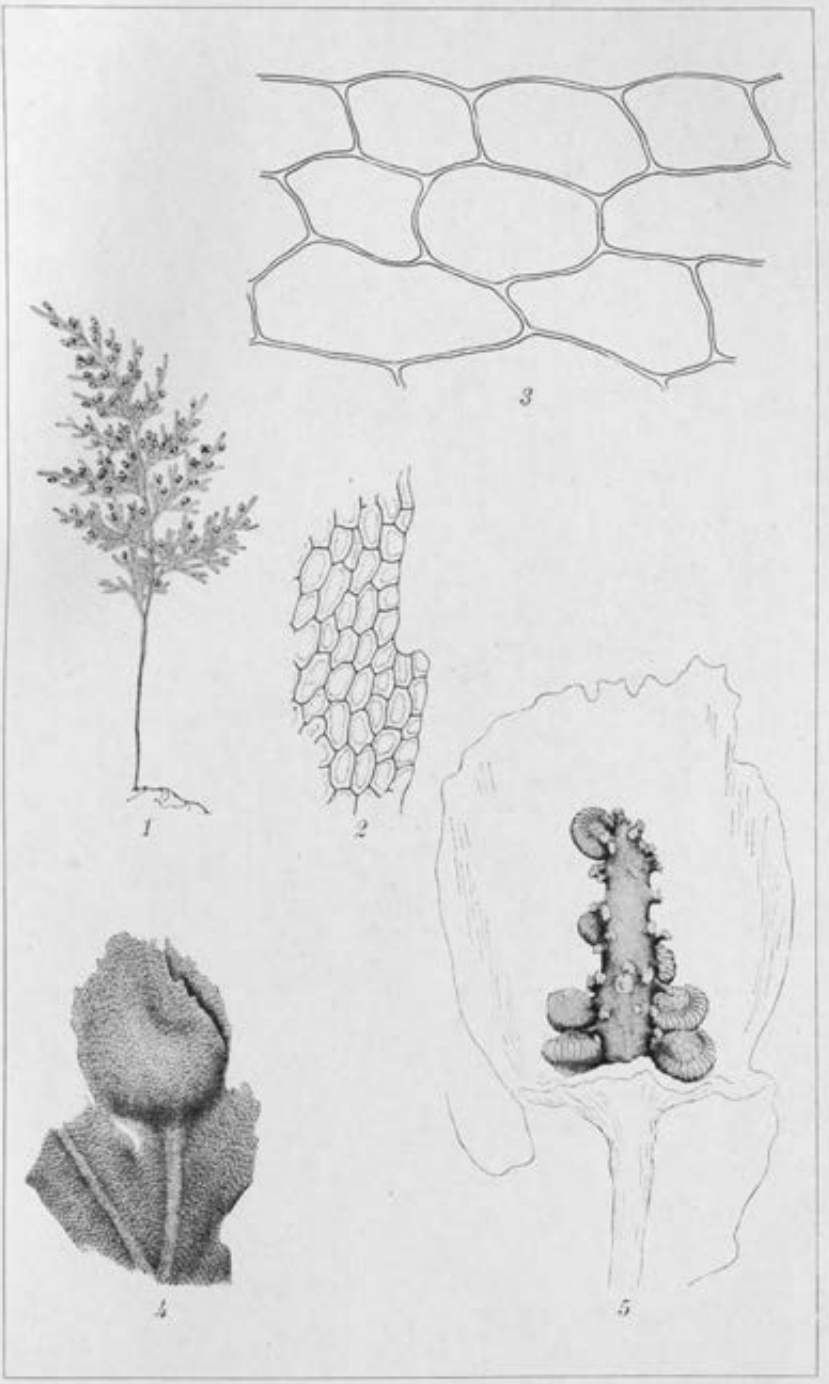

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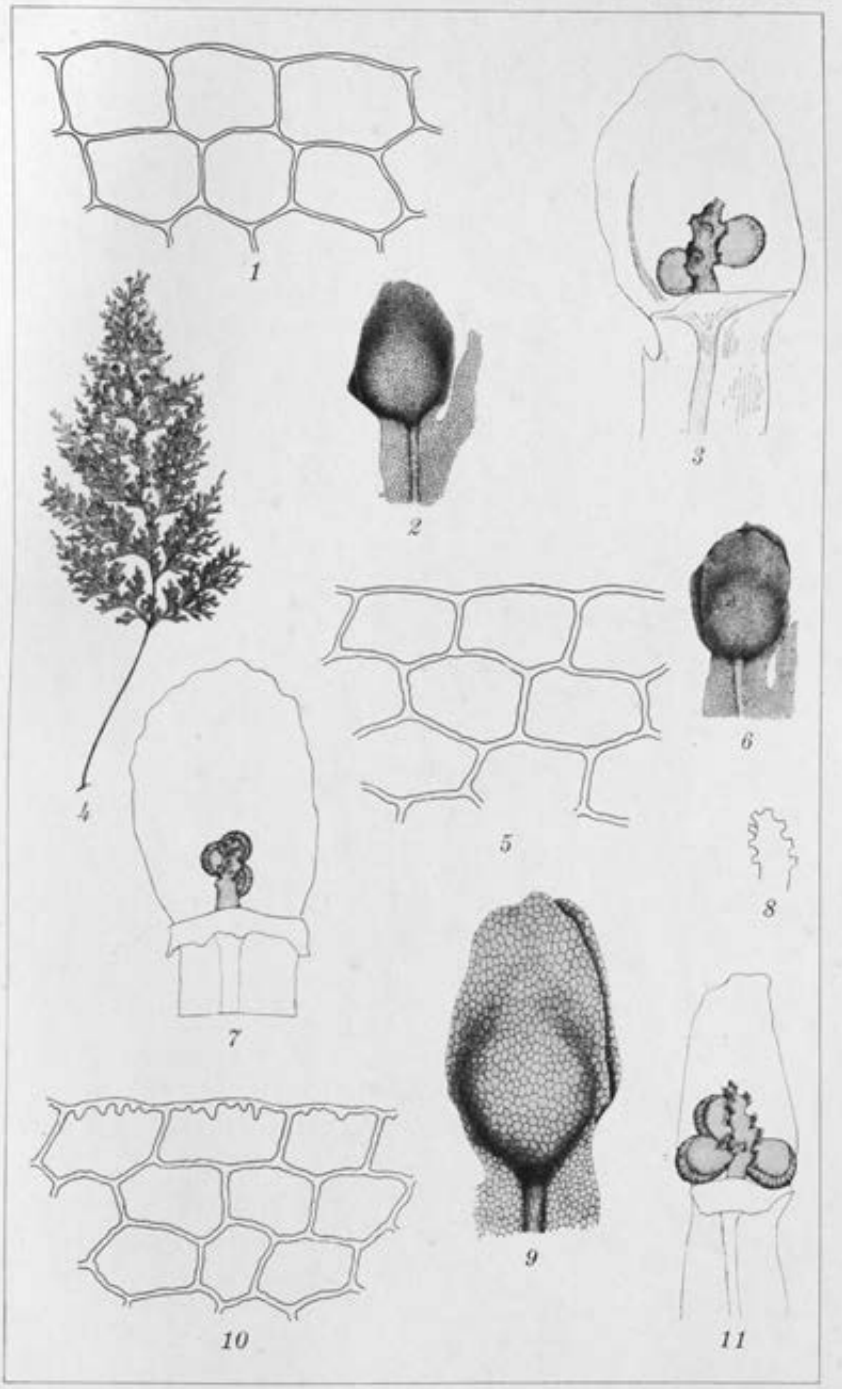

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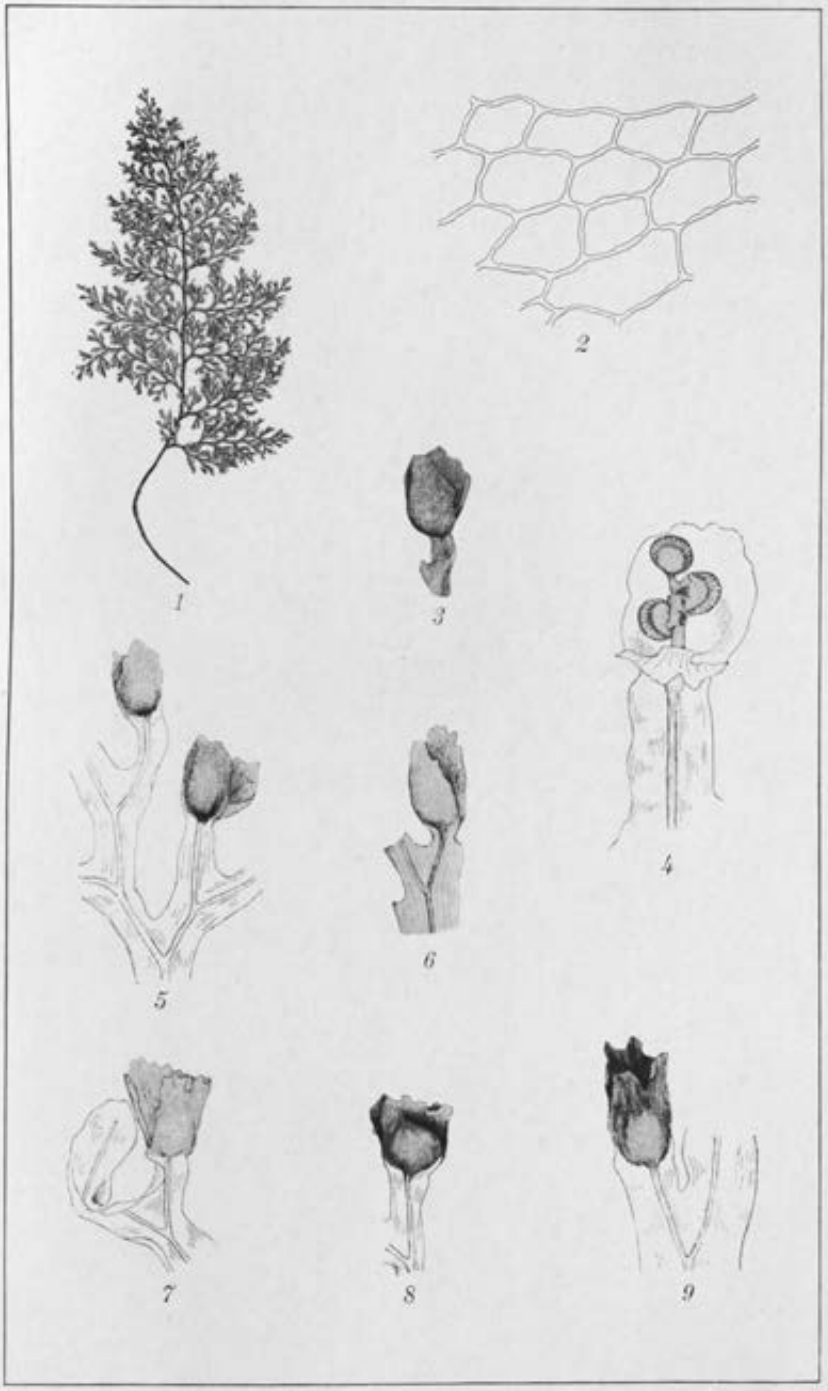

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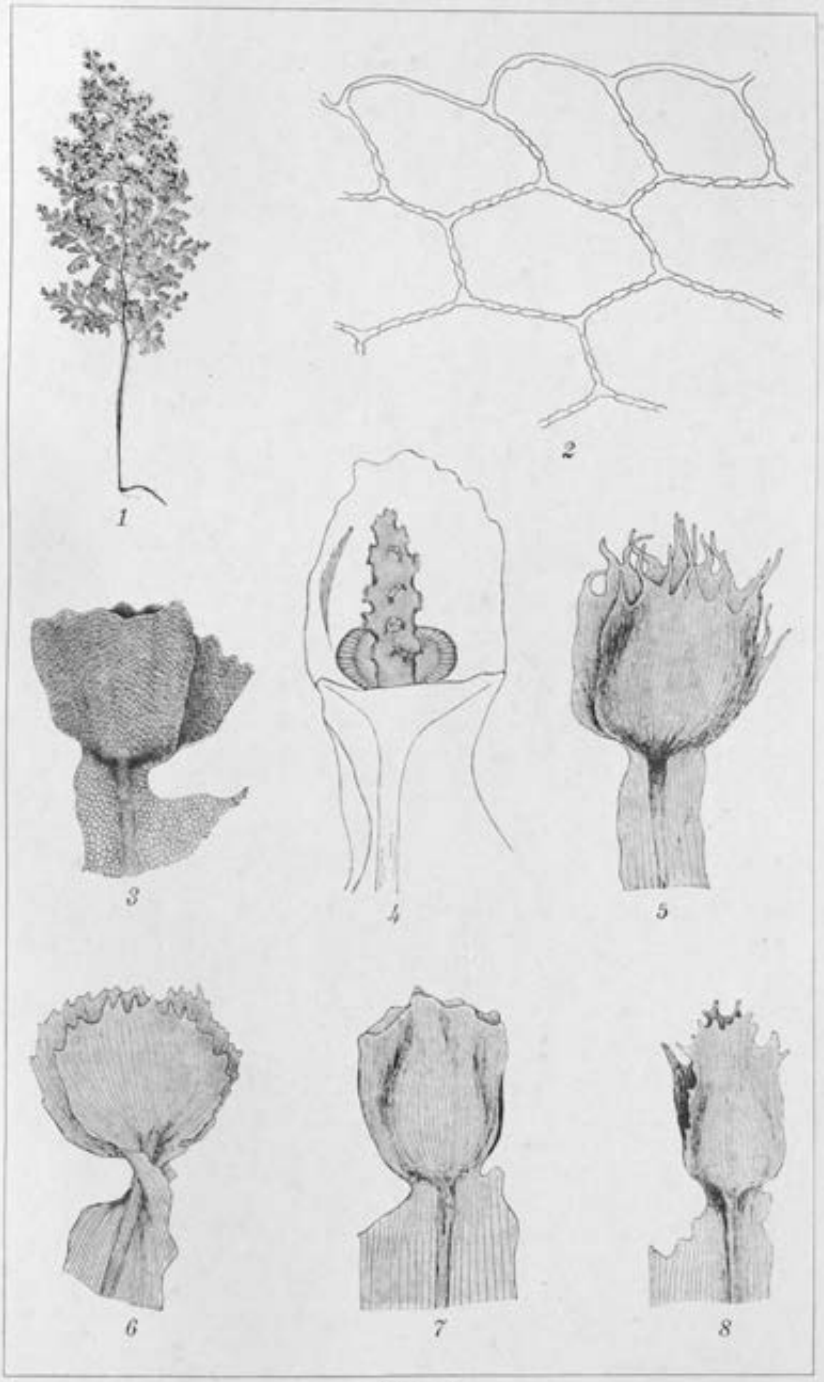

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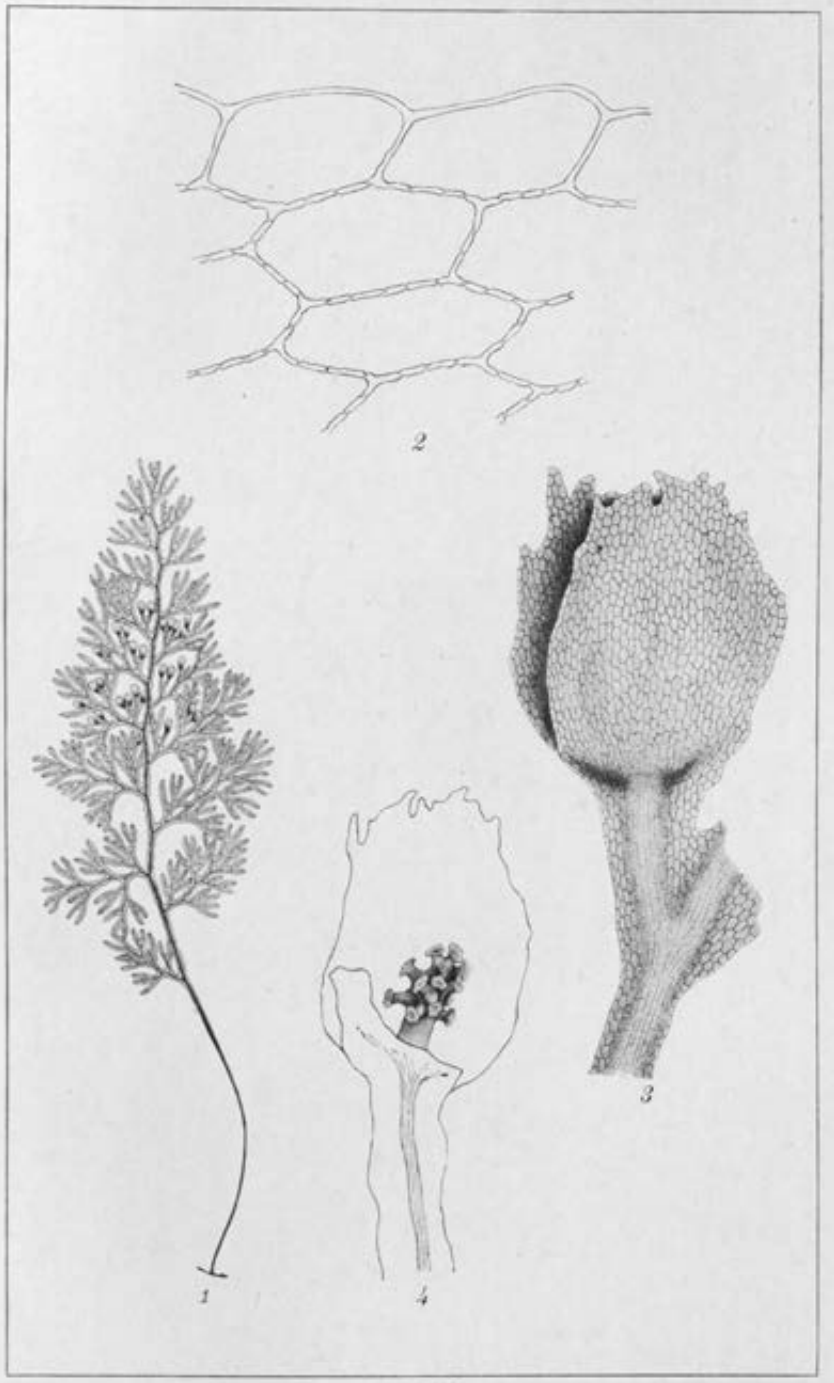

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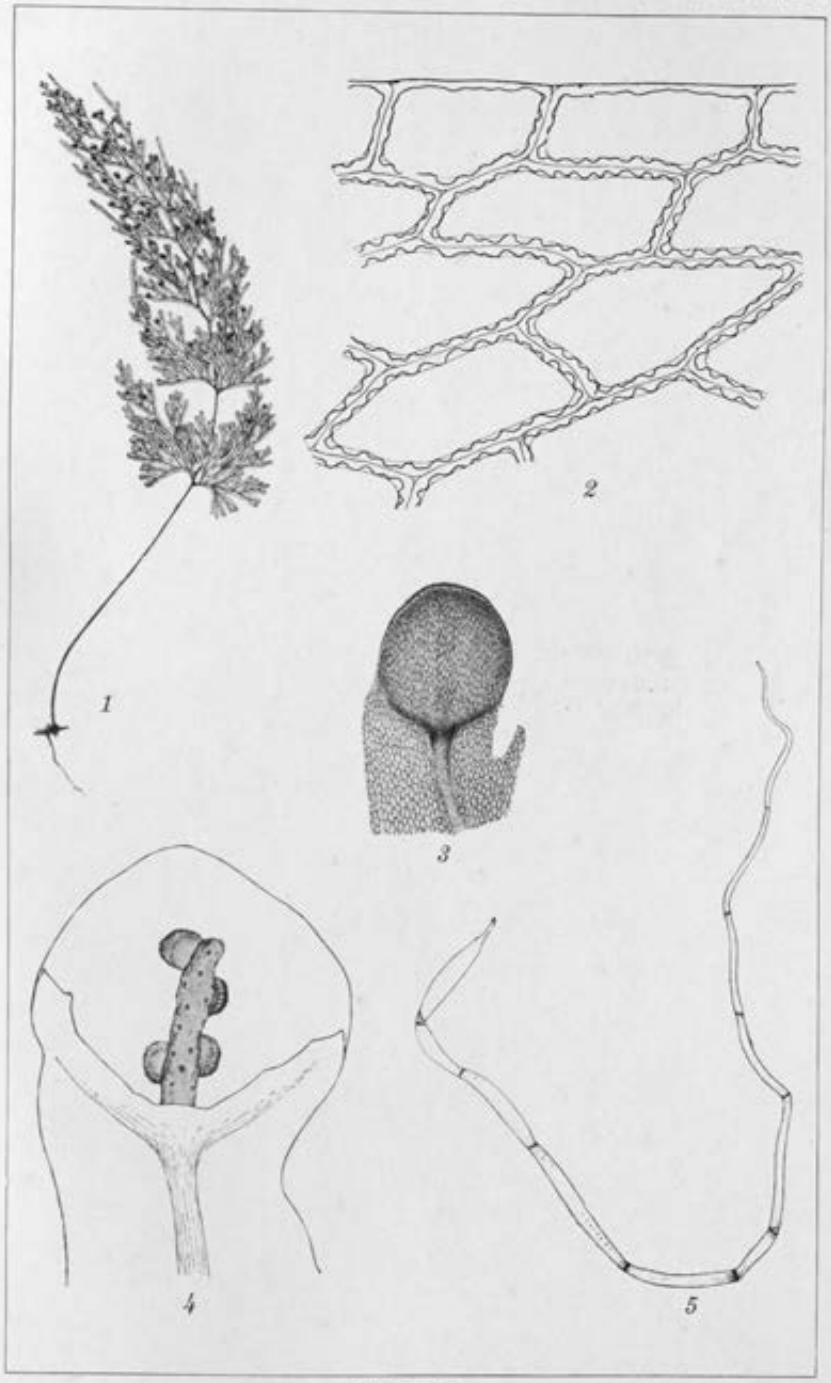

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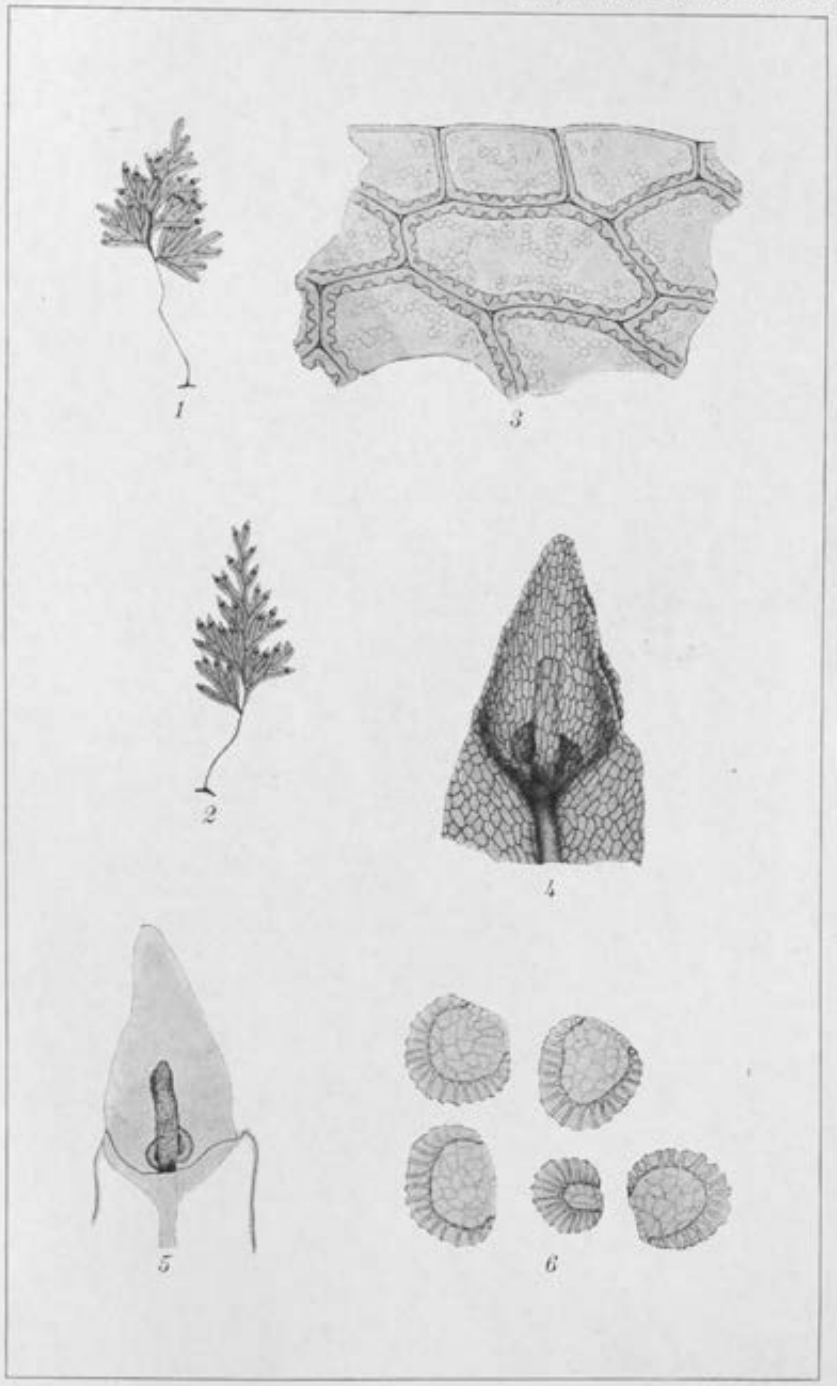
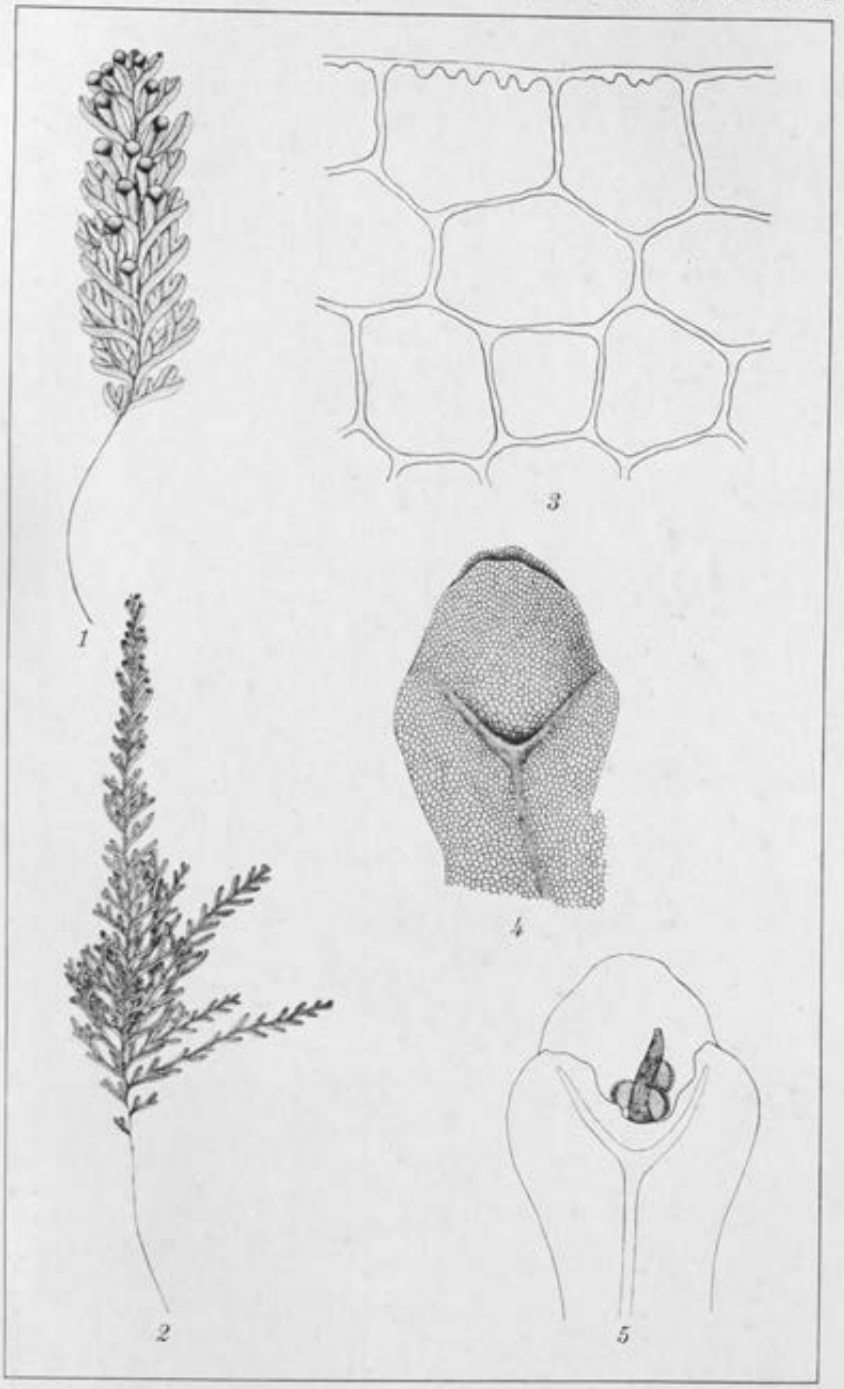


PLATE 63.



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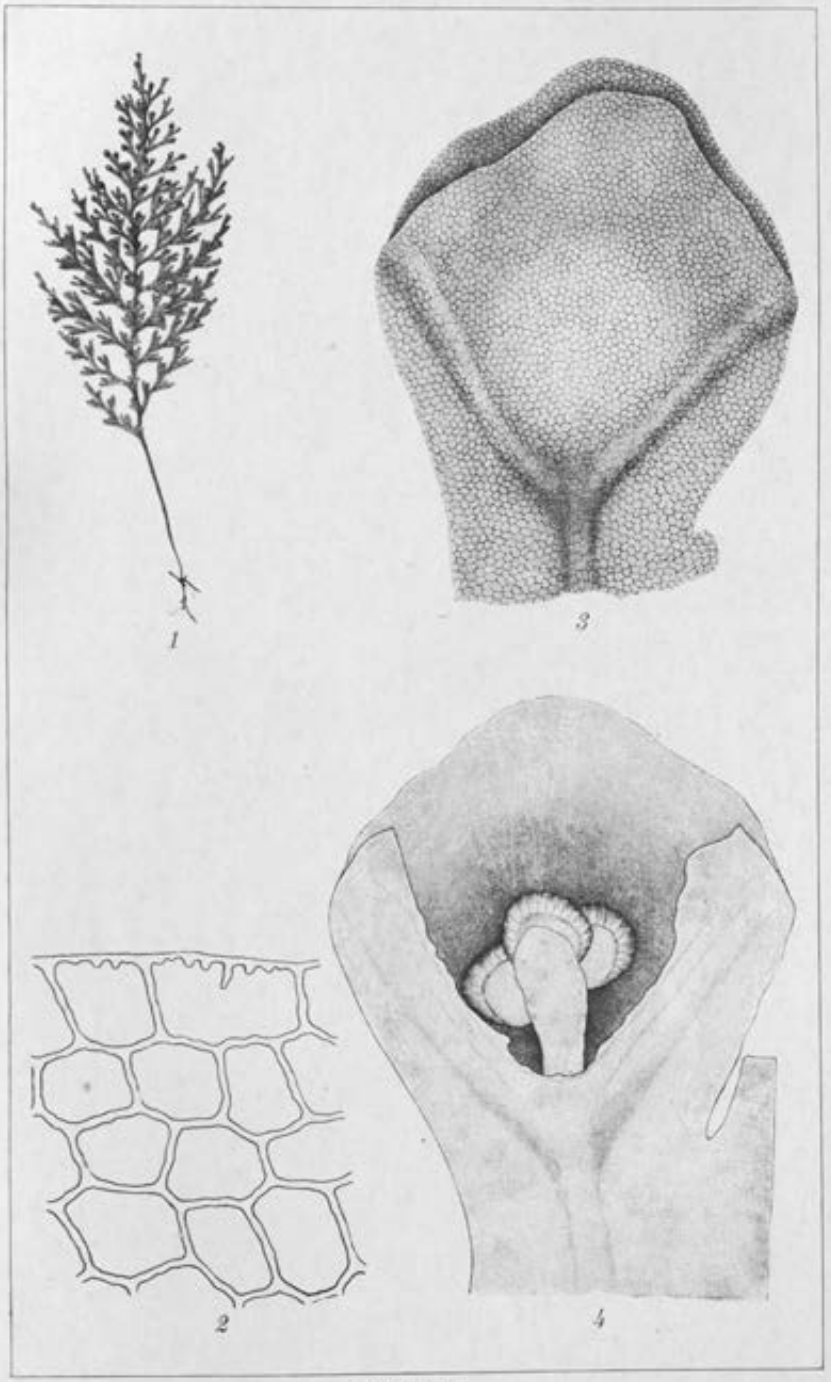

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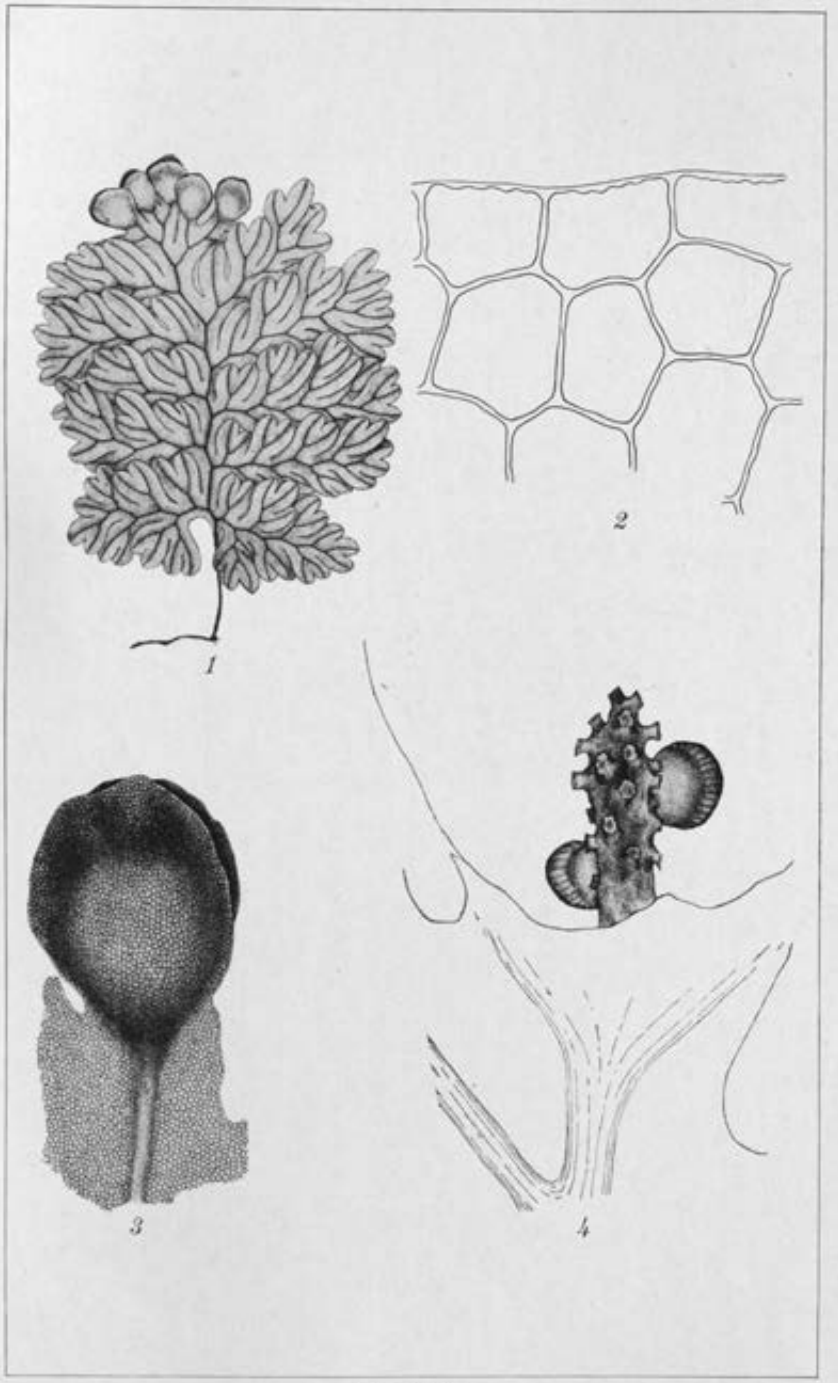

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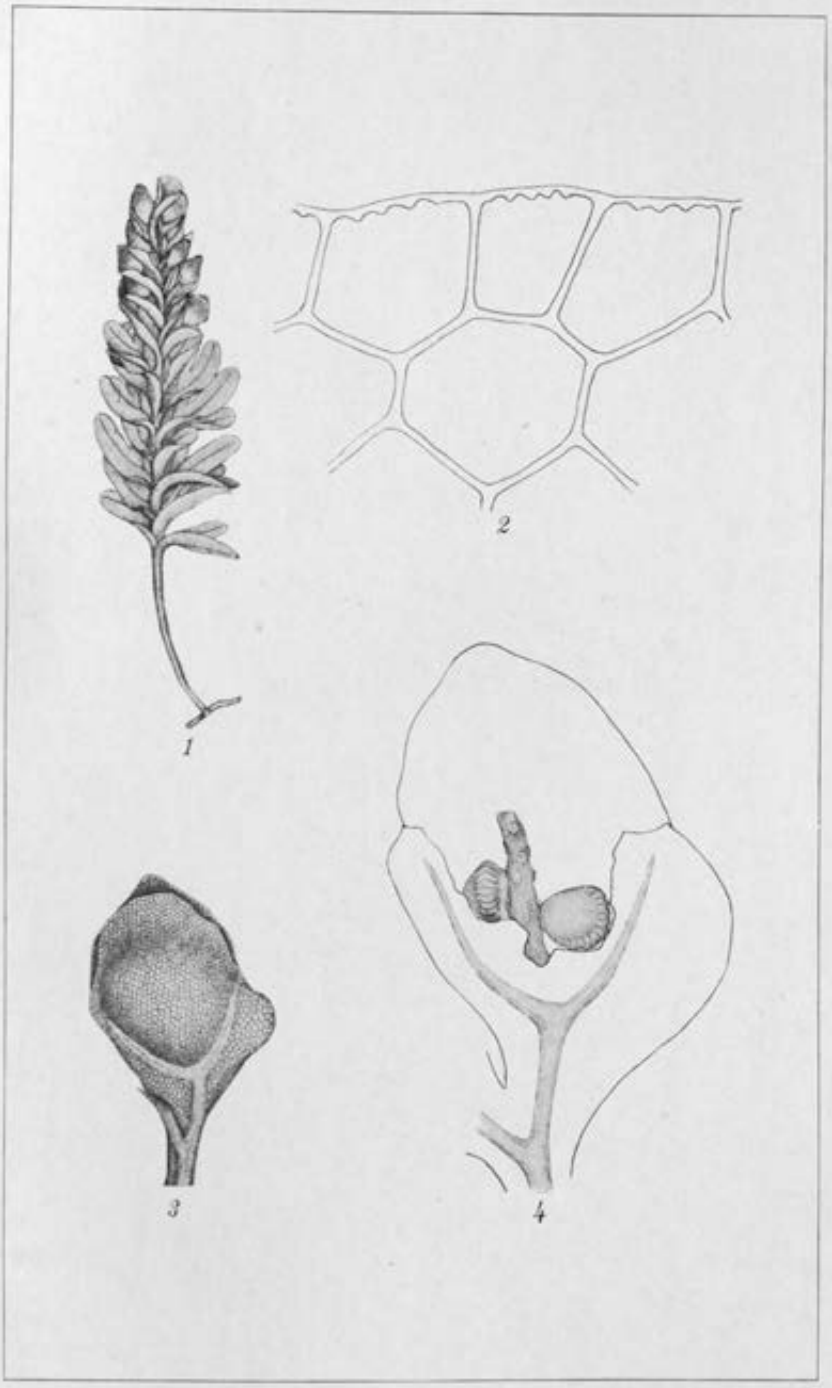

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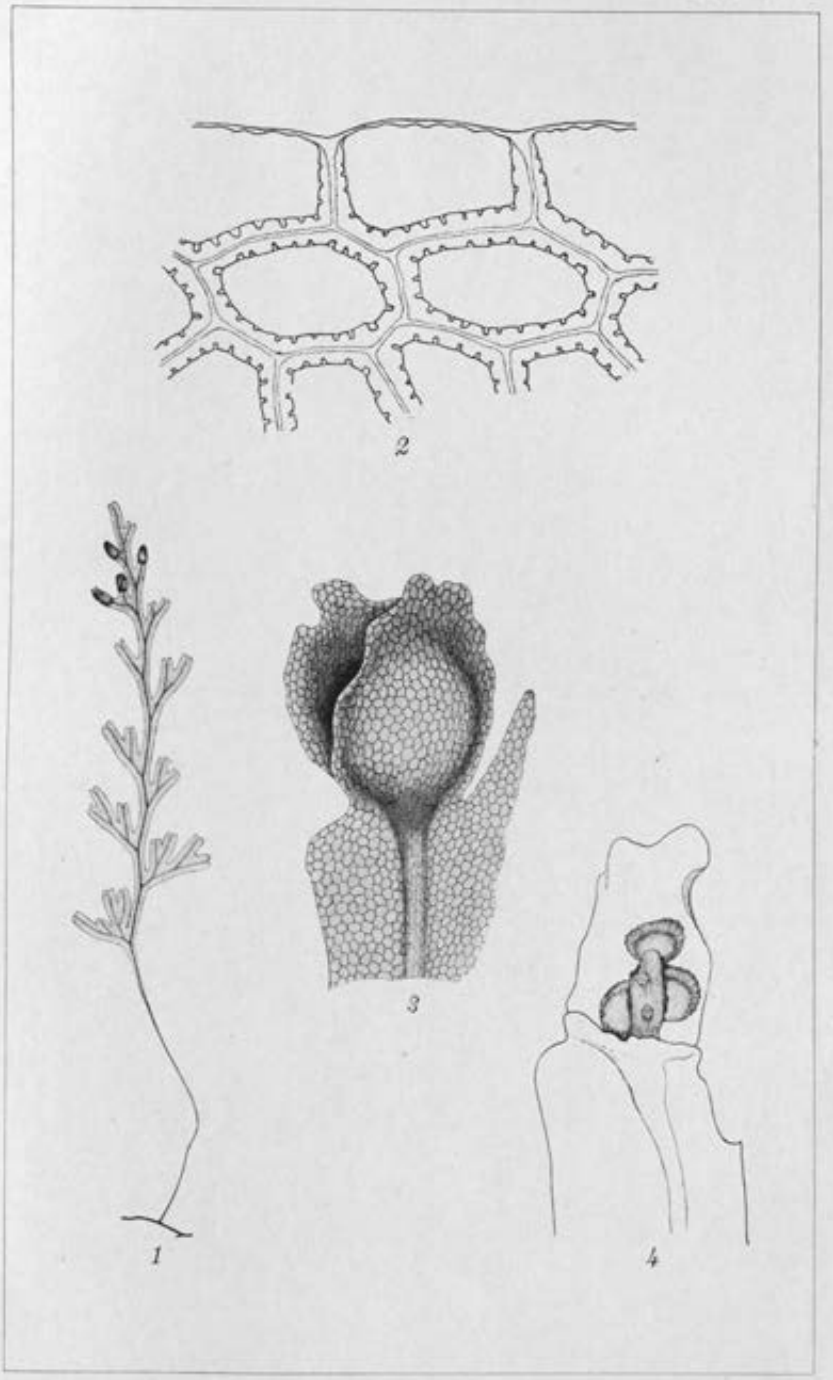

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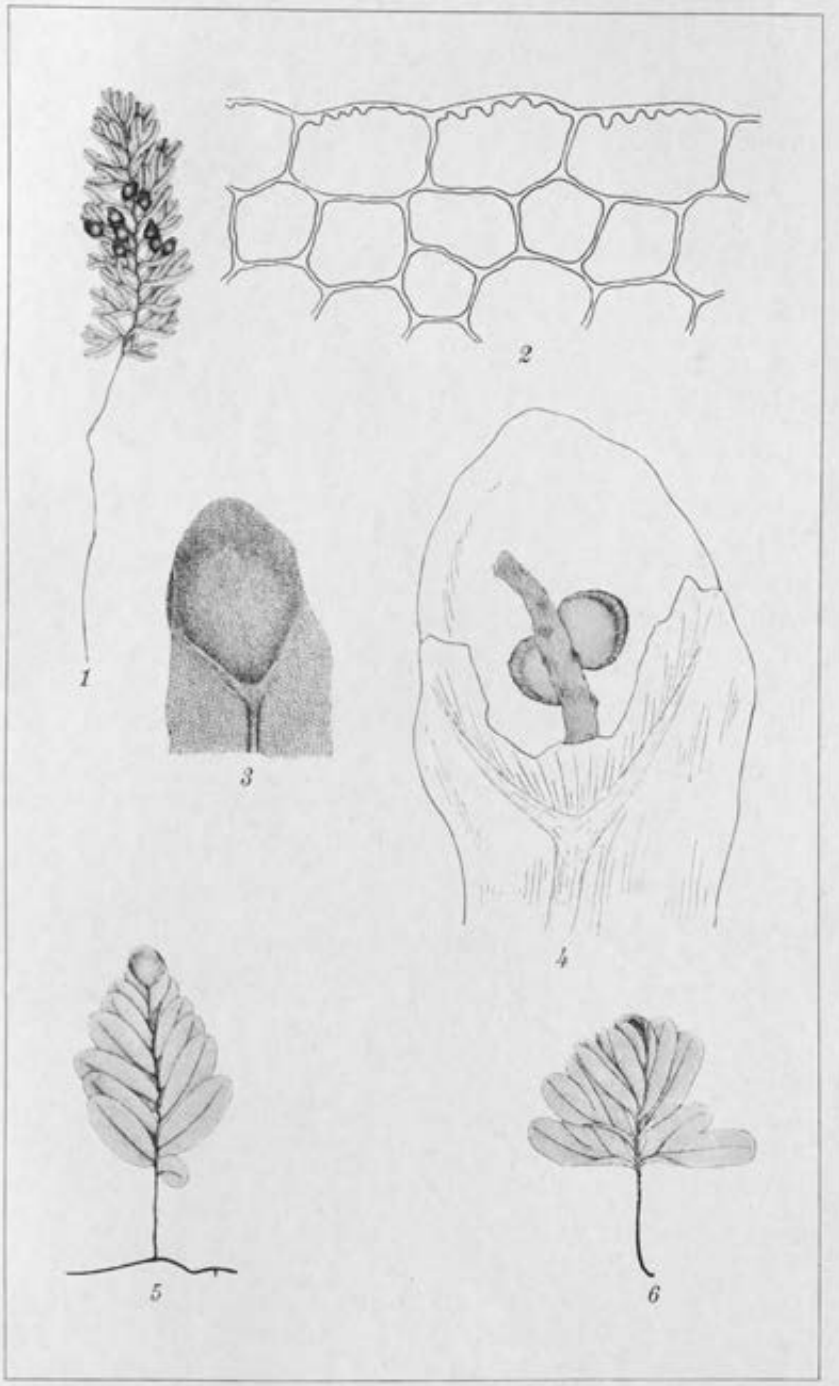

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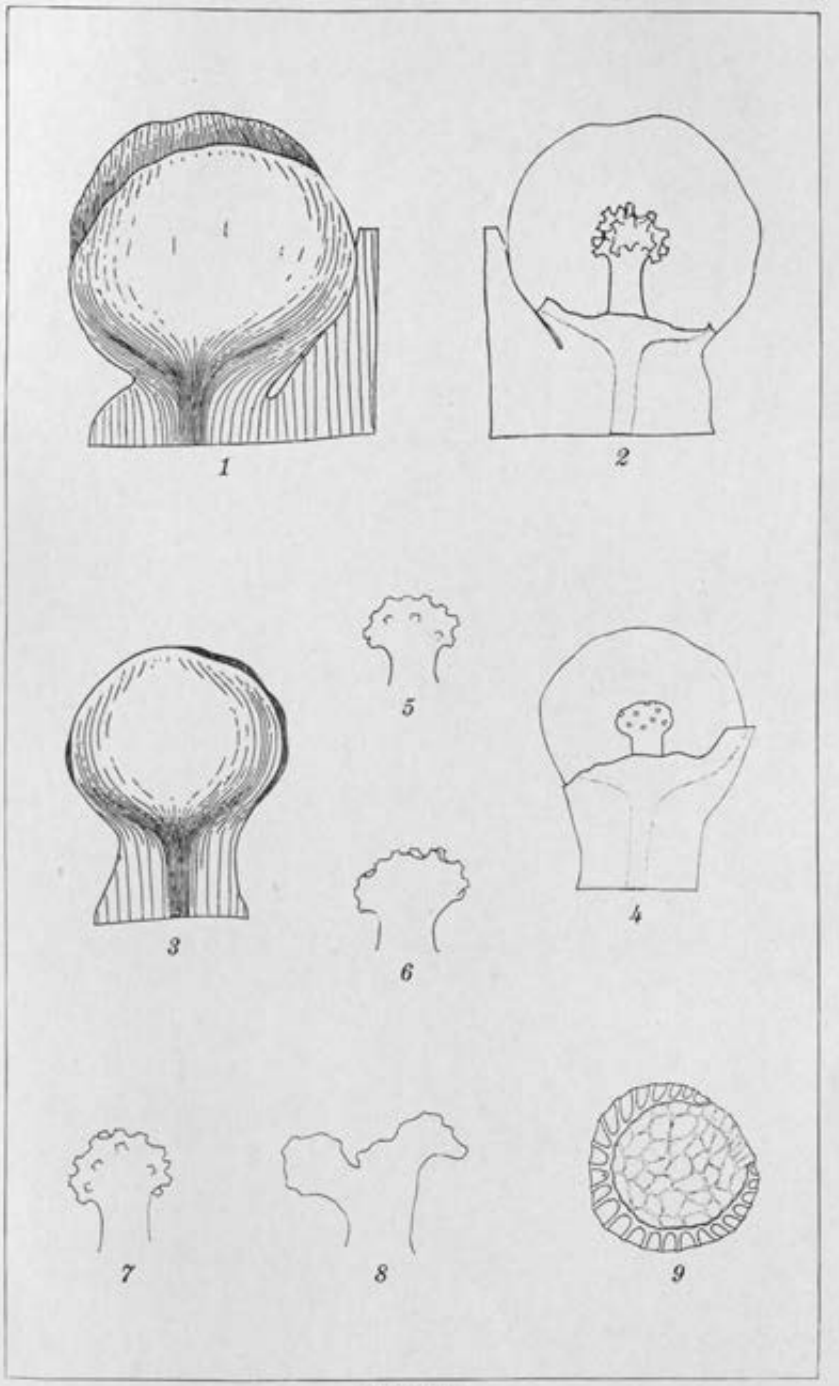

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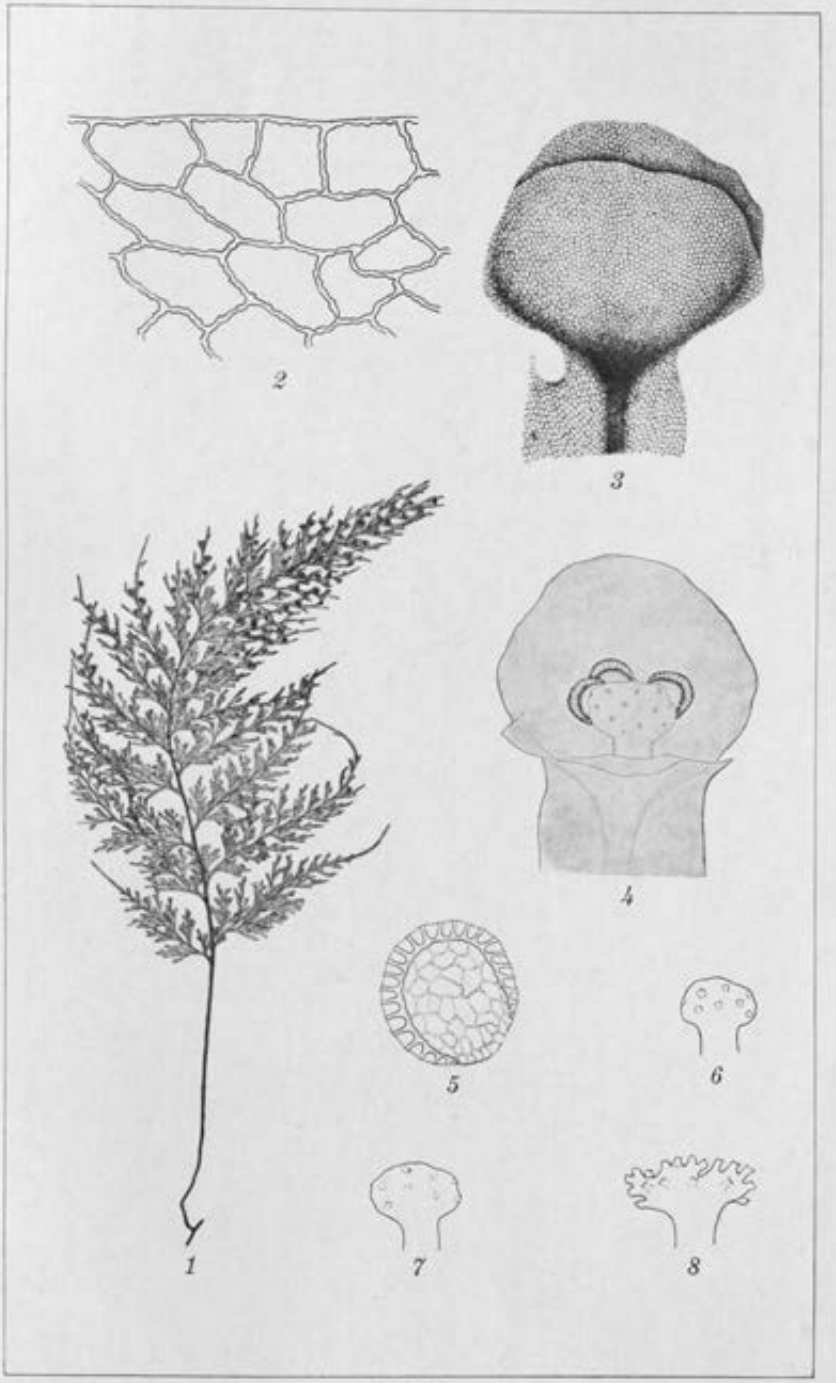

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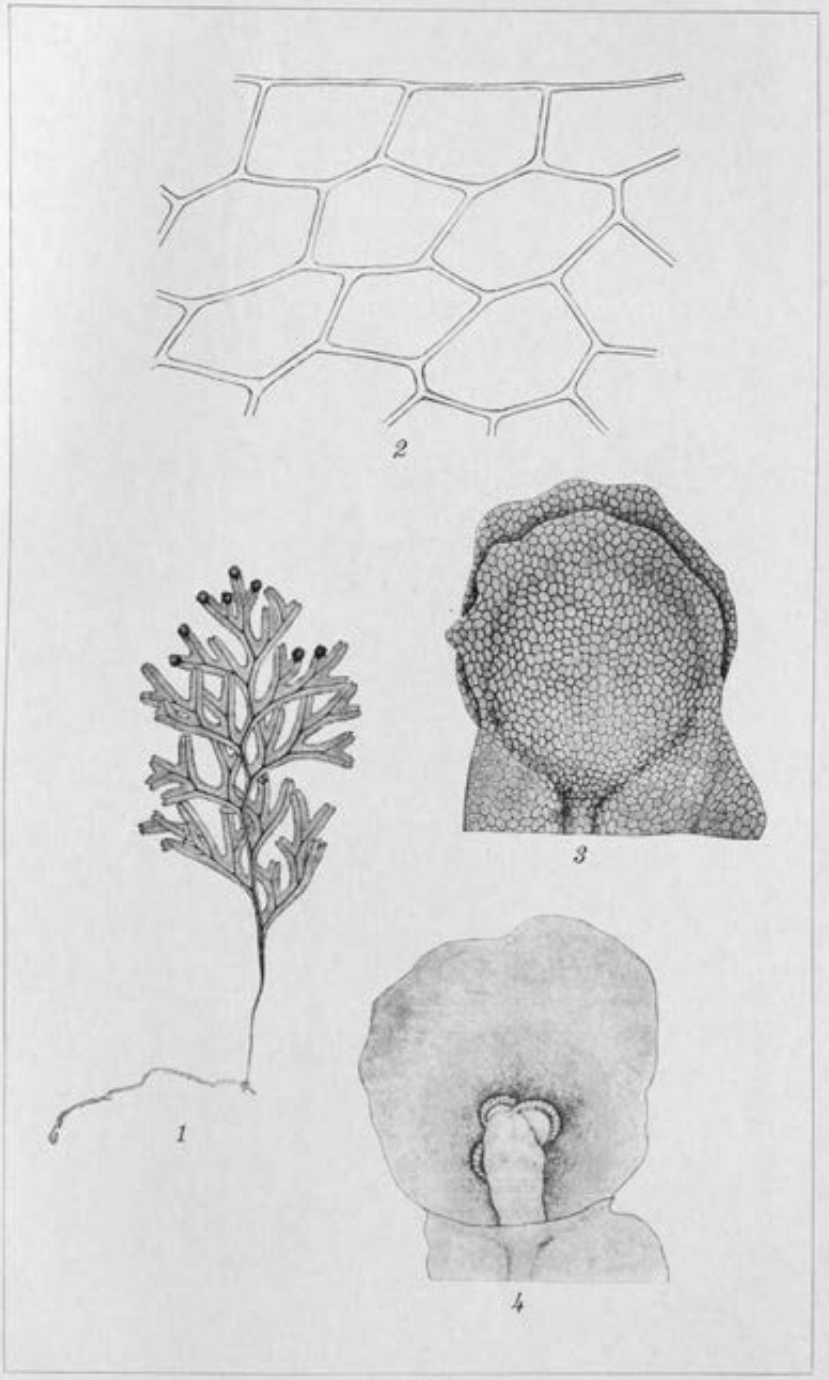

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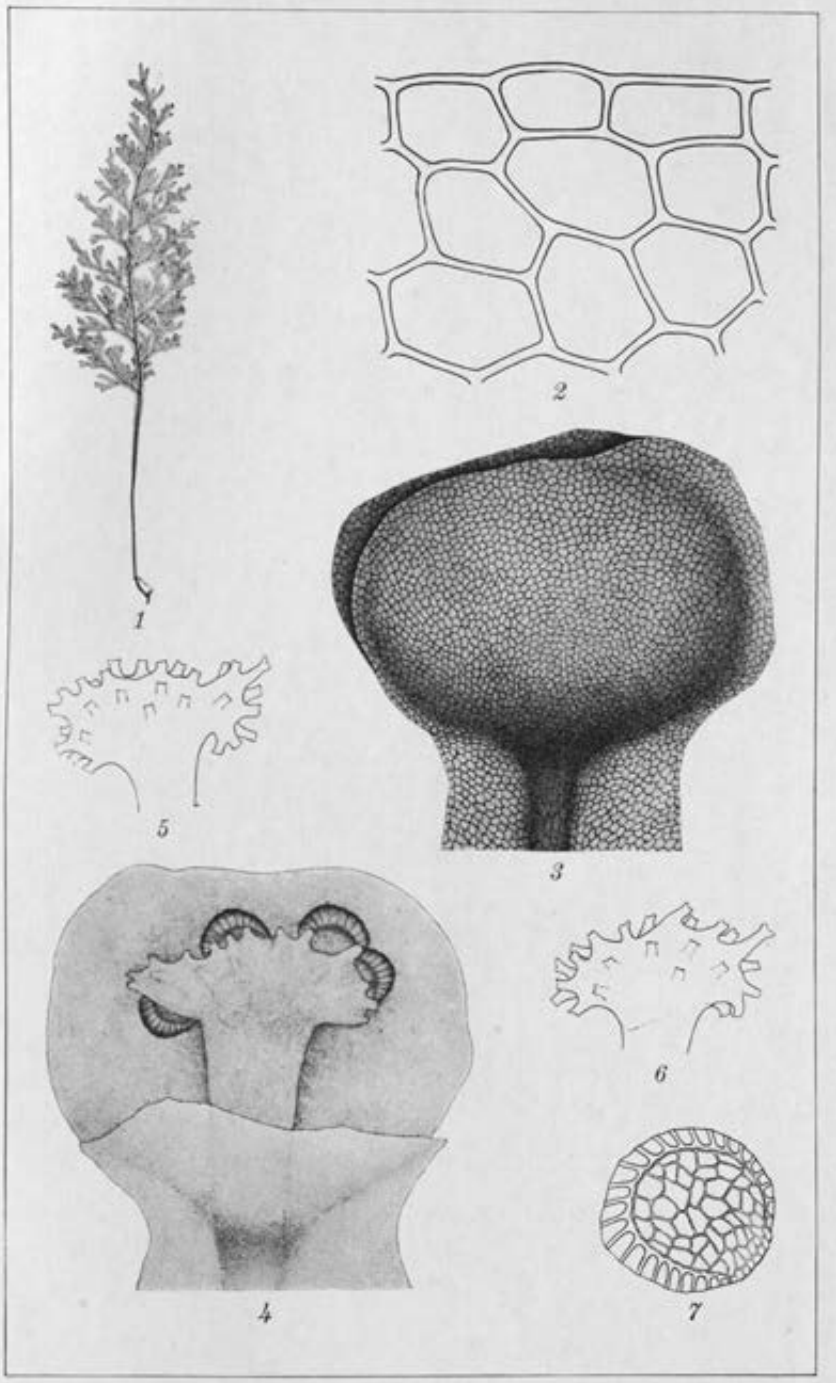

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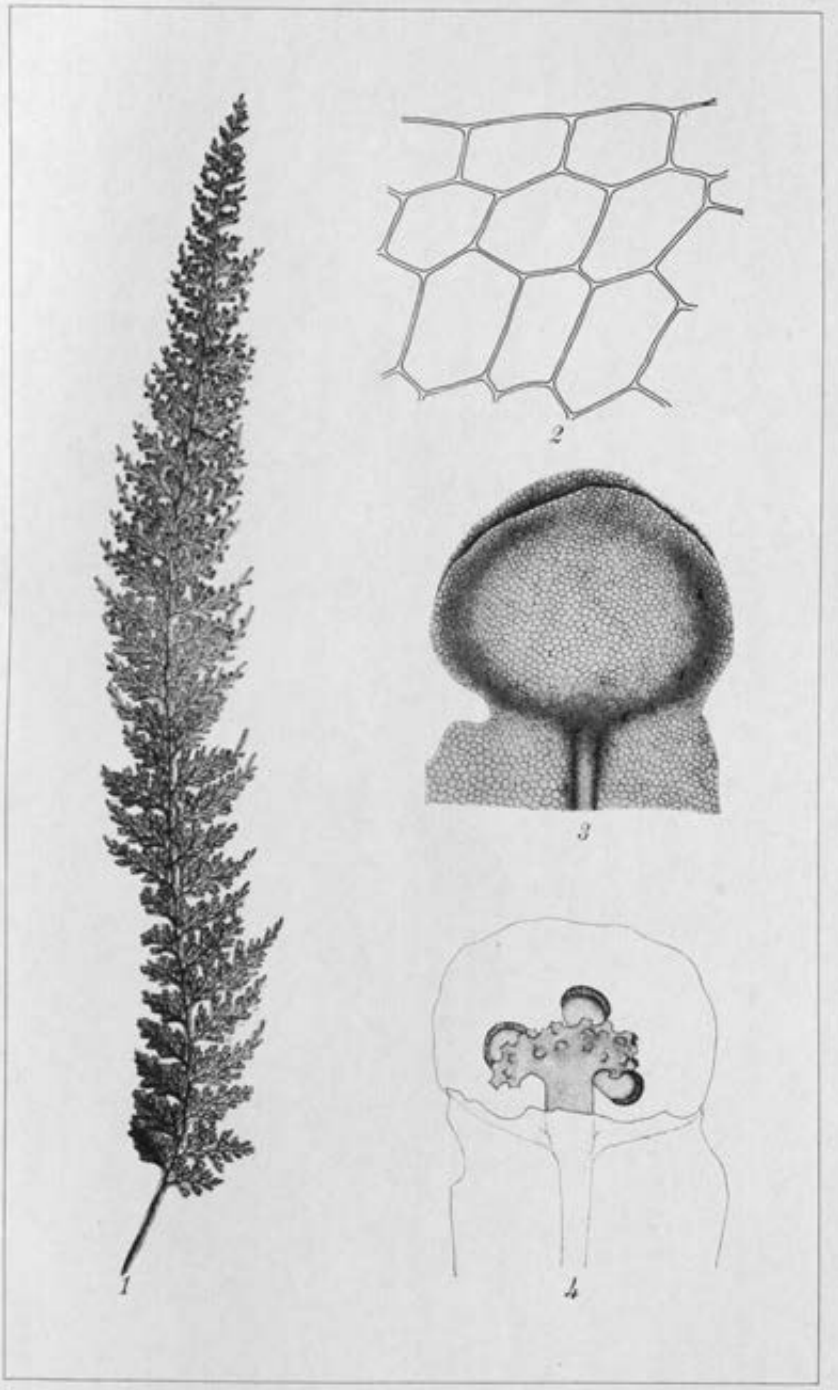

PLATE 74.

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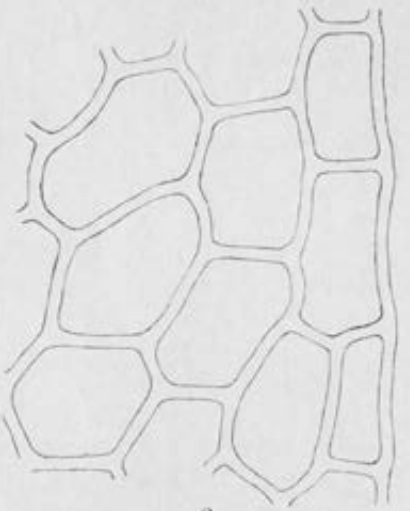

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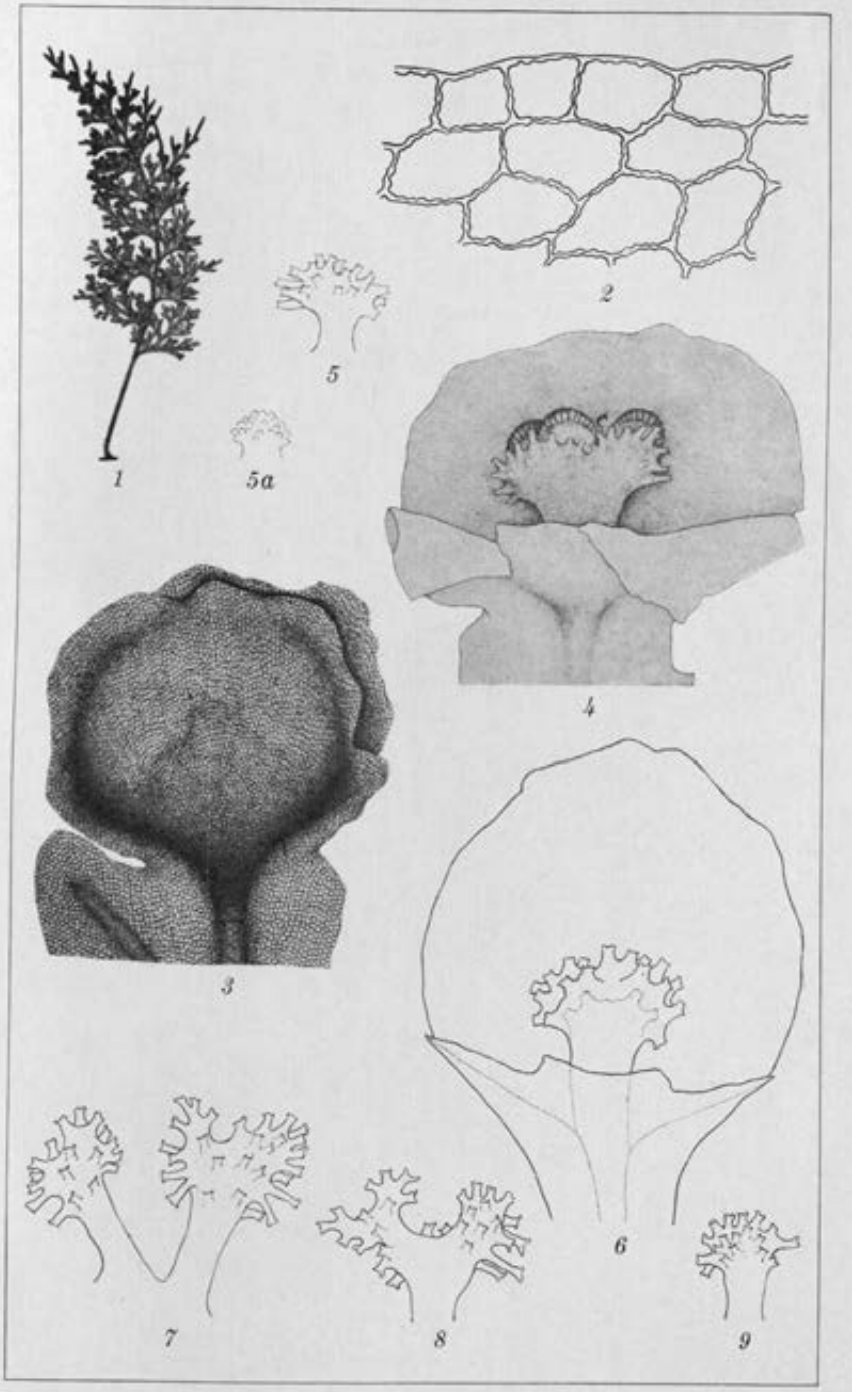
PLATE 75.



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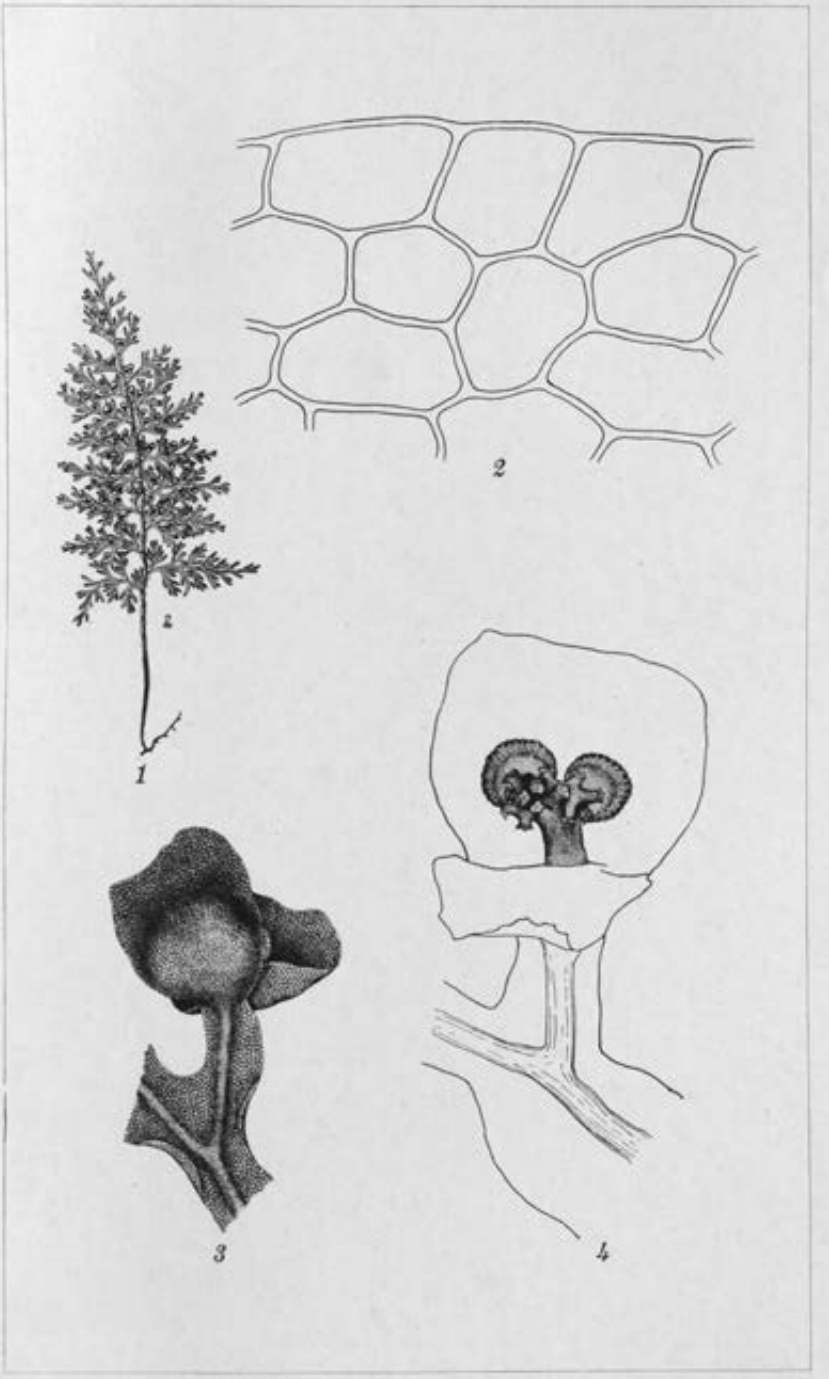

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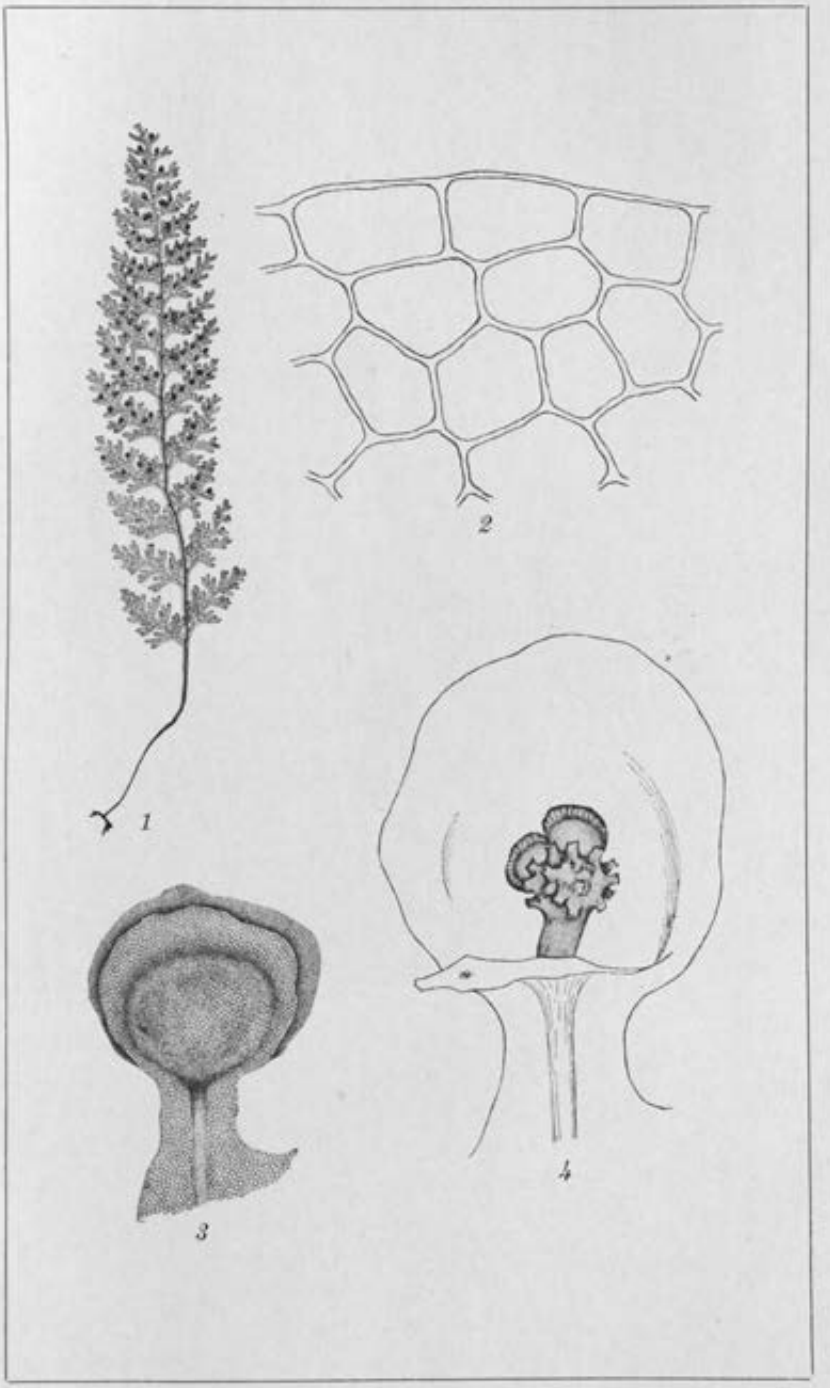

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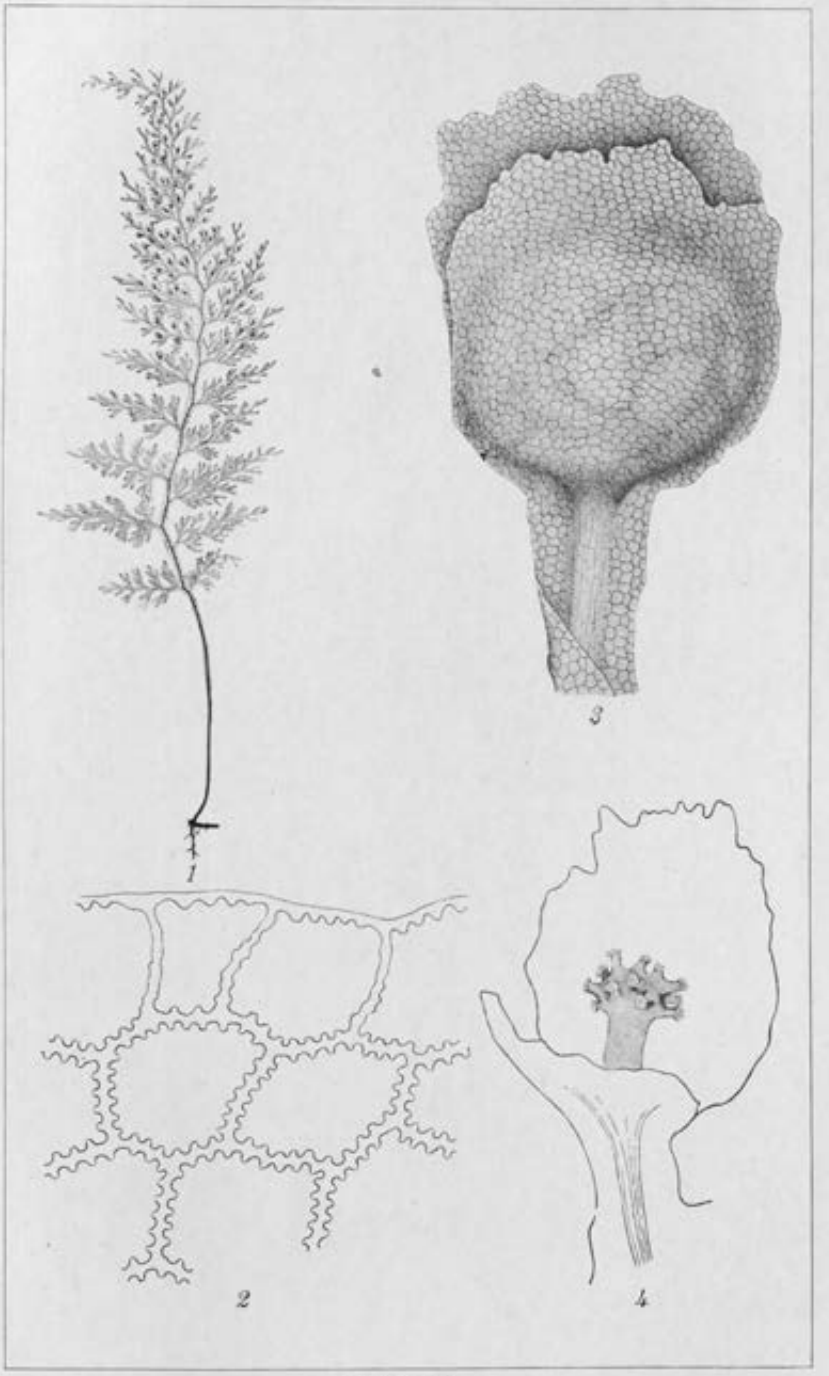

PLATE 79.

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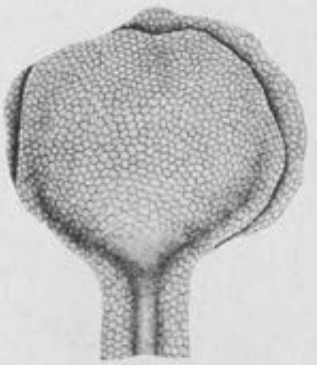

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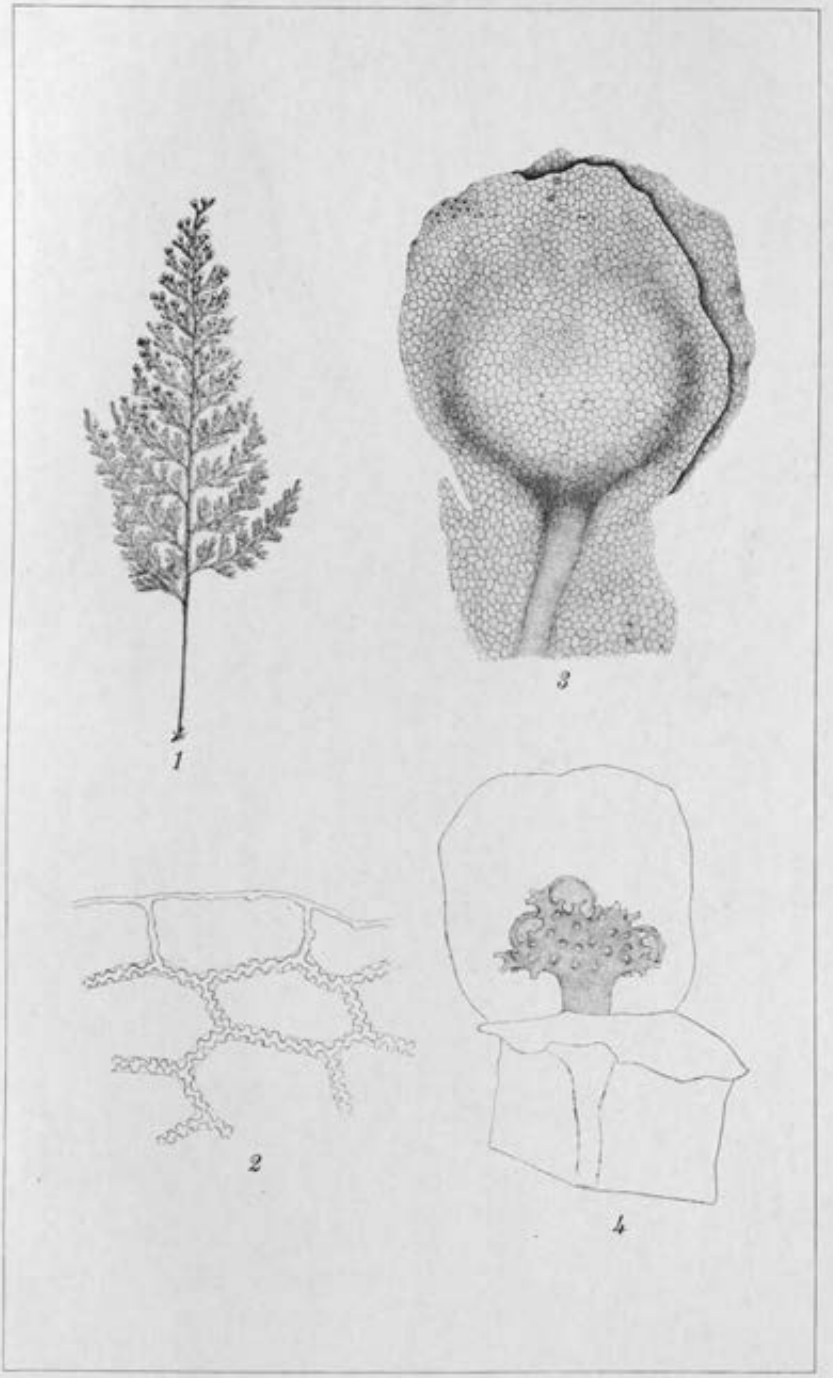

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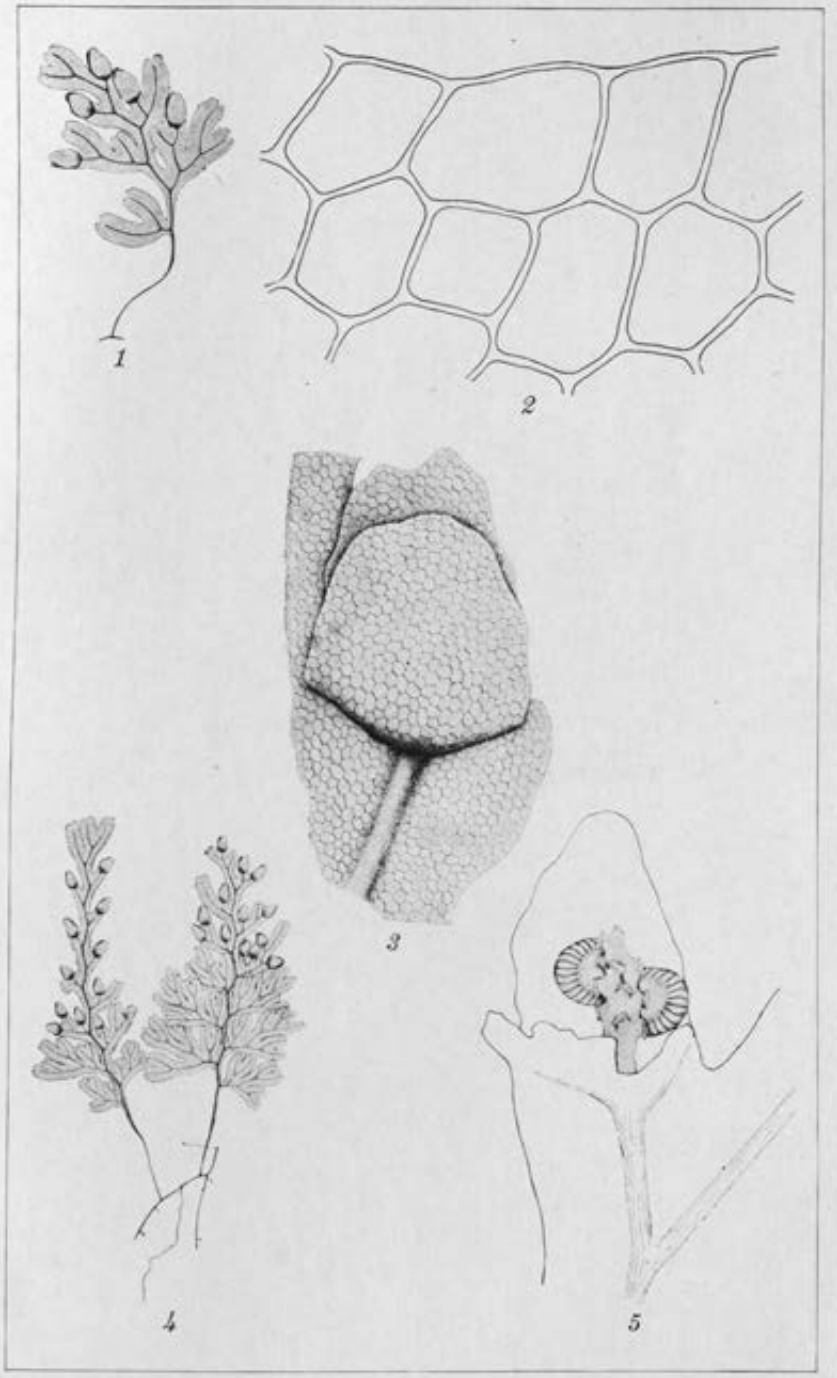

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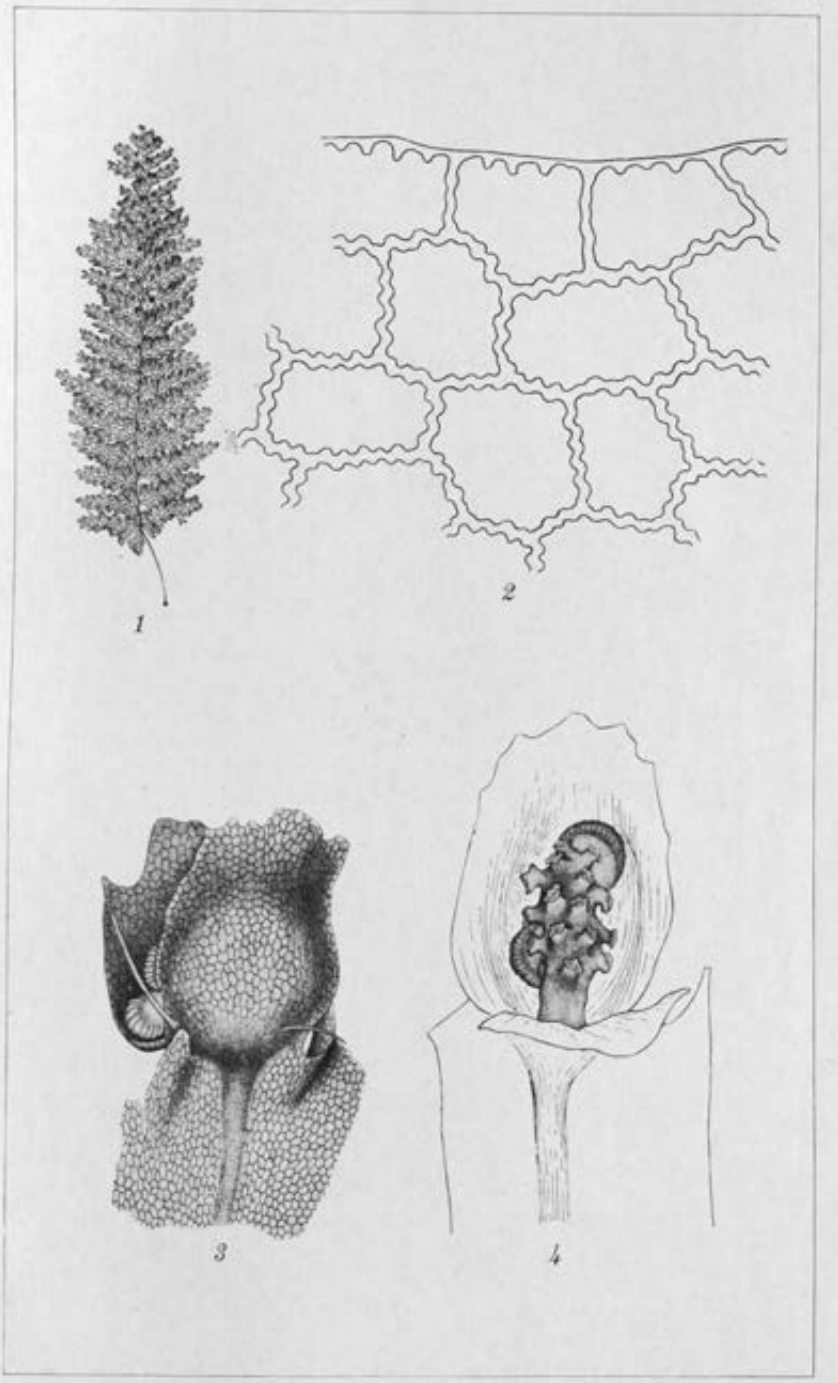

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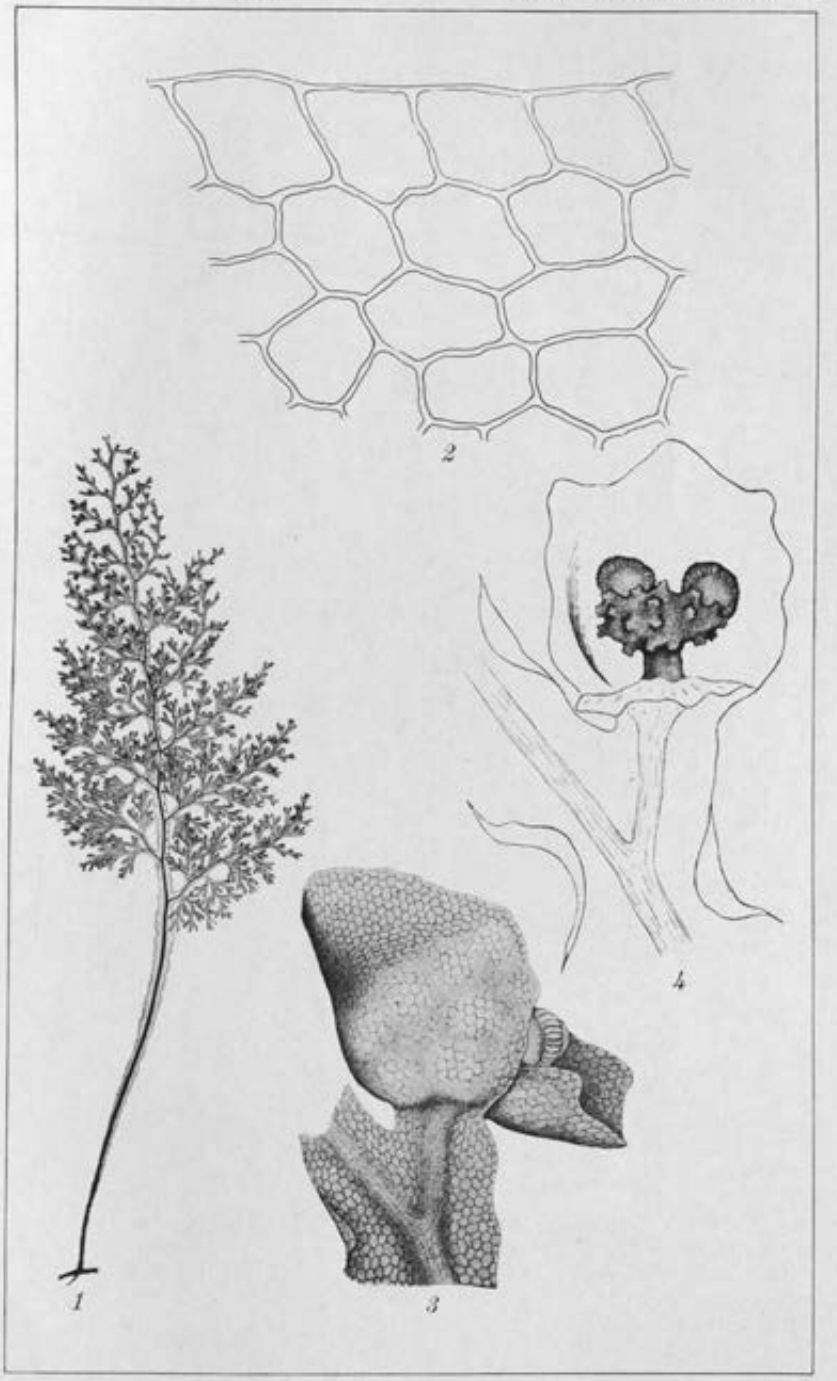

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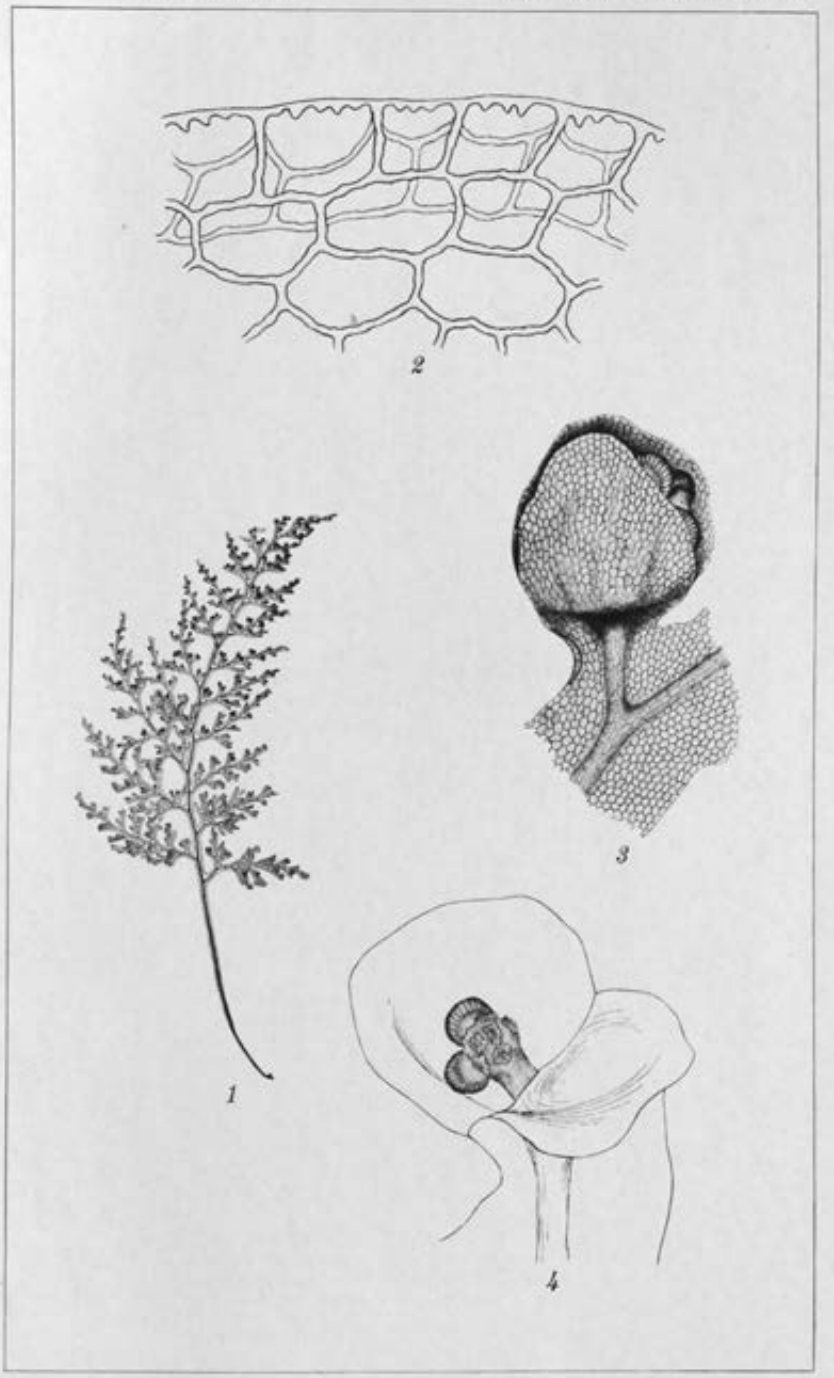


PLATE 85.

PLATE 86.

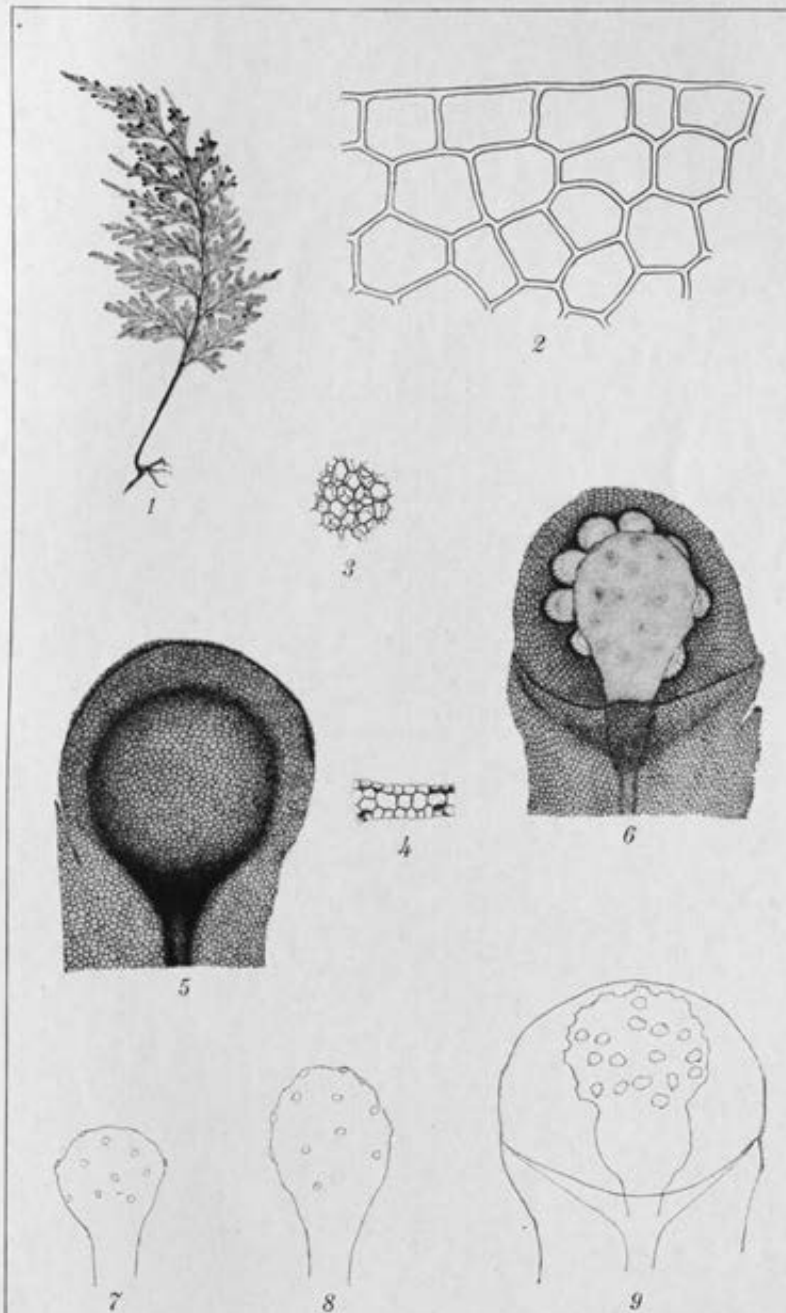
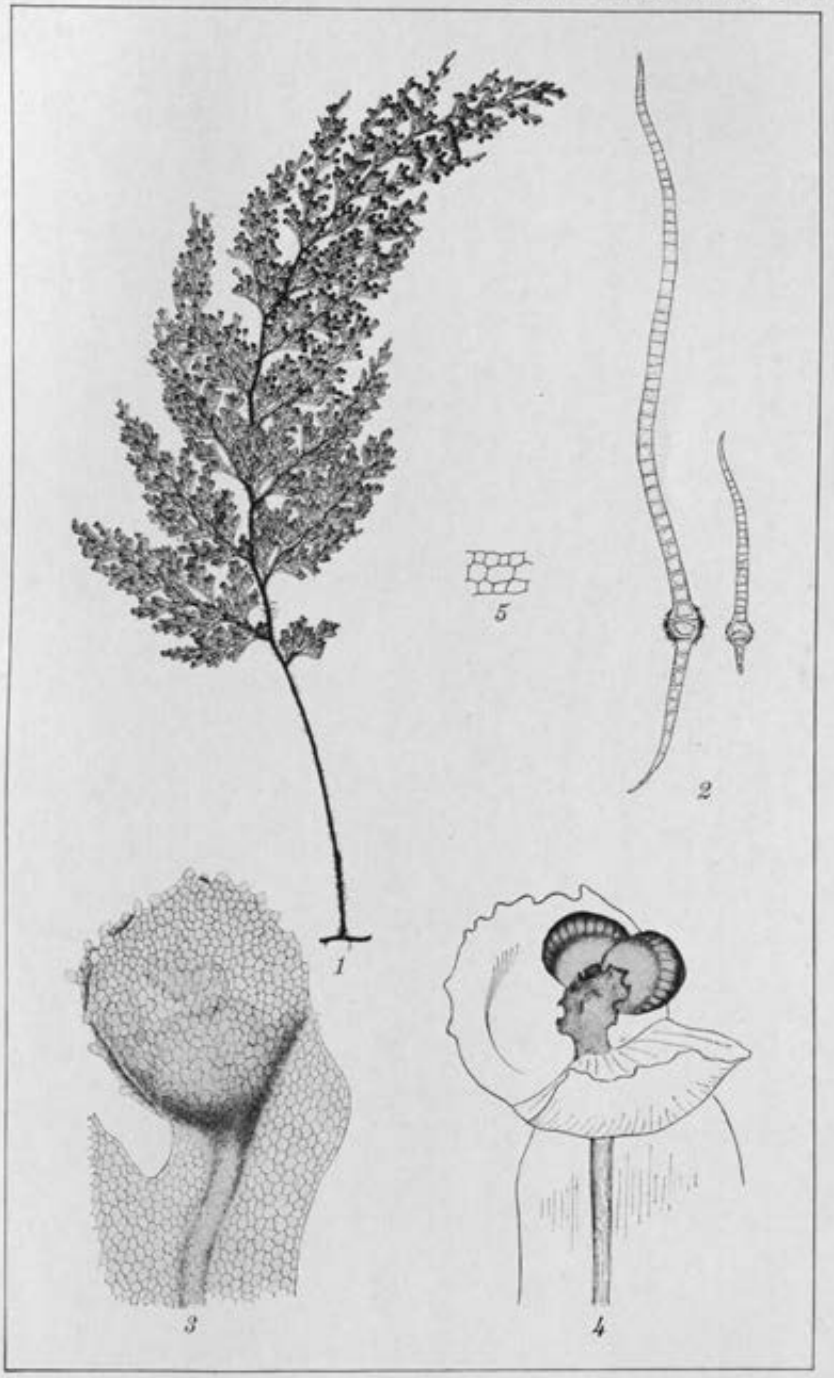


PLATE 87.



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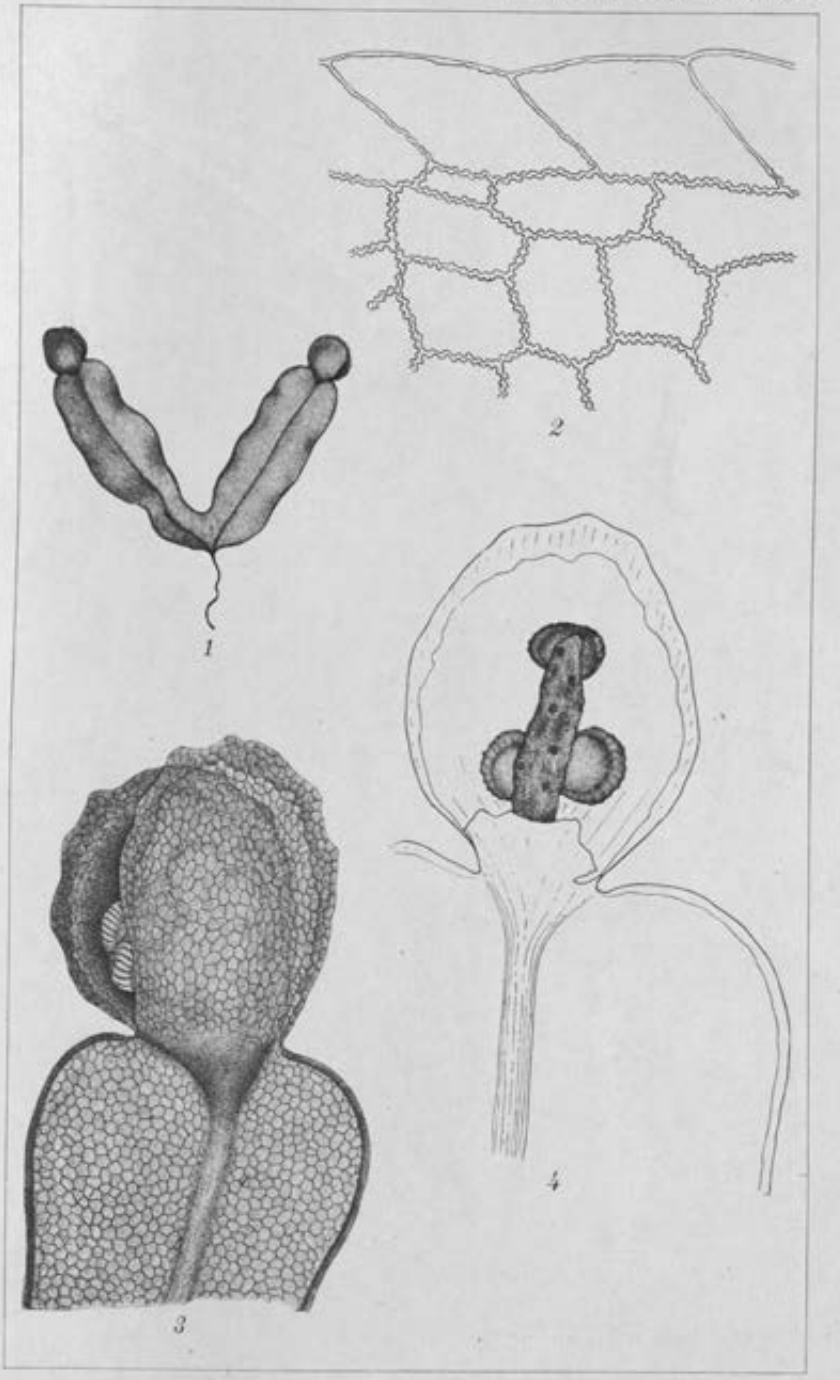

PLATE 89.